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Report of the second session of the

FISHERY COMMITTEE FOR THE EASTERN CENTRAL ATLANTIC (CECAF)
WORKING PARTY ON RESOURCES EVALUATION

Rome, 3 - 6 December 1973

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
ROME, 1975

REPORT

of the

SECOND SESSION OF THE FISHERY COMMITTEE FOR THE EASTERN CENTRAL ATLANTIC (CECAF) WORKING PARTY ON RESOURCES EVALUATION

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Rome, January 1975

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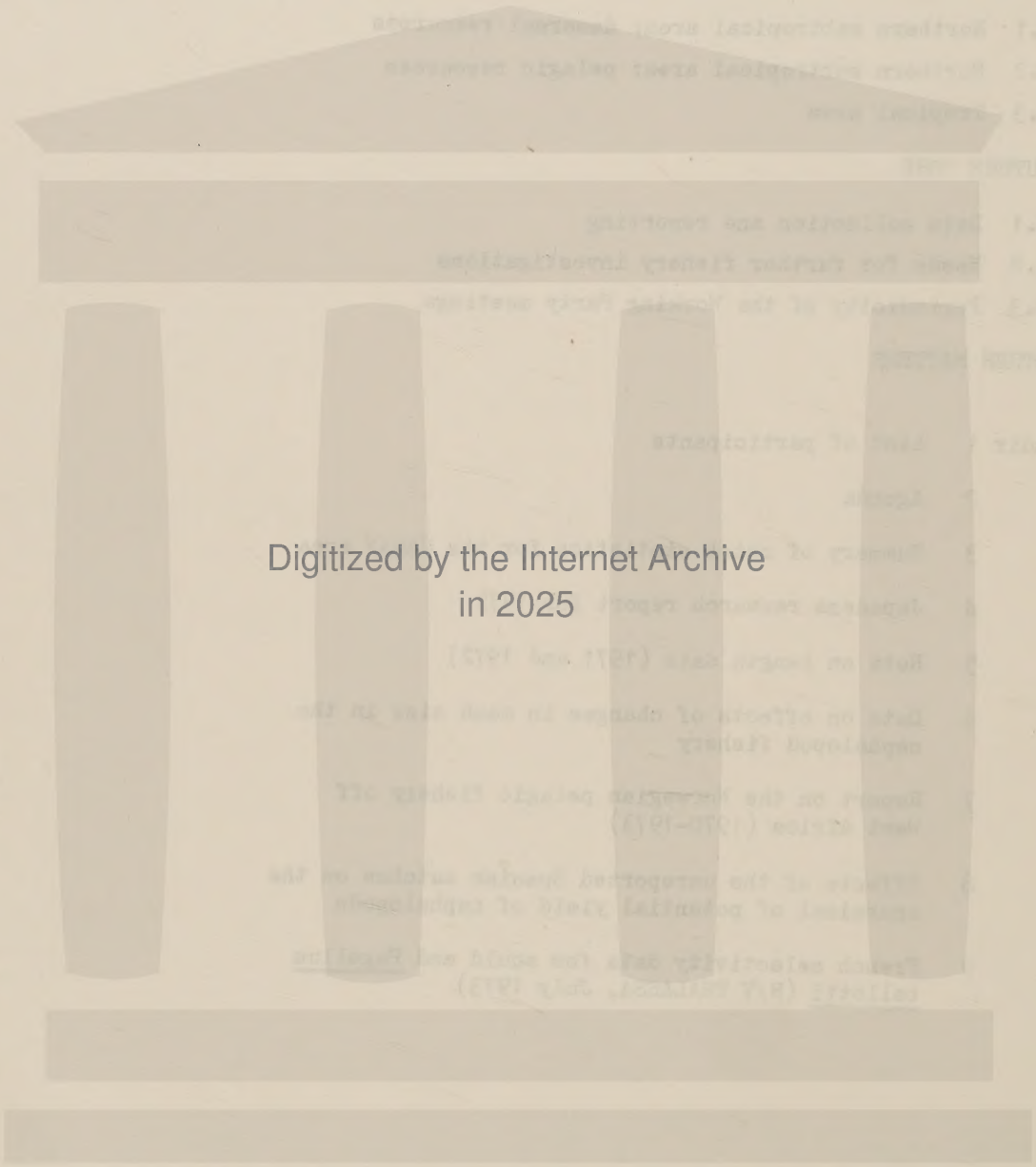

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1 INTRODUCTION

The Working Party on Resources Evaluation held its Second Session at FAO Headquarters, Rome, from 3 to 6 December 1973 with Mr. E.O. Bayagbona (Nigeria) as Chairman. The list of participants is given in Appendix 1. The agenda, as adopted, is given in Appendix 2.

The Working Party reviewed the state of the fish resources of the region by analyzing recent data on stocks and fleet activities collected by the Working Party correspondents and the Secretariat since its previous meeting. The data available are still far from being complete. This unavailability of appropriate information is one of the major constraints encountered by the Working Party in fulfilling its task. This problem, as well as the ways of overcoming it, at least partly, was discussed at length during the session (see Section 3.1).

2 REVIEW OF PRESENT STATE OF EXPLOITATION OF THE STOCKS

2.1 Northern subtropical area: demersal resources

2.1.1 Hakes

In former reports of the Working Party the overall potential for the three species of hakes combined has been estimated at around 20-25 000 tons. A better break-down of catch statistics which were reported allows the estimation of annual catches of European and Senegalese/Mauritanian hakes separately (see Appendix 3). Statistics reported in the FAO Yearbook of Fishery Statistics (Vol. 33) were amended according to additional information provided by participants in the Working Party. For instance, recent unofficial information regarding the Greek fishery indicates that Greek trawlers are no longer fishing for hakes in the CECAF region. Annual catches reported by Spain and U.S.S.R. are substantially higher in 1972 than during the previous years. For Spain it is believed that this increase results from better reporting and an improved break-down of catches by geographical divisions. This implies that Spanish catches for previous years were underestimated, and rough estimates have been made based on what is known of the development pattern of the Spanish fishery. Although the provisional working table given in Appendix 3 is based on some assumptions, it should provide a picture of total catches as well as catches by countries for these two groups of species that is more realistic than previous tabulations.

C.p.u.e. data are available up to 1971 for the Portuguese trawlers fishing mainly for hakes in the Sahara Coastal Division (Table 1), where areas of distribution of European hake on the one hand, and Senegalese/Mauritanian on the other, overlap. Catch and effort estimates are also available from 1959 to 1972 for Moroccan trawlers operating in the Morocco Coastal Division (Table 2). Length frequency distributions are available from Bulgaria, France, Morocco and Portugal (Table 3).

Senegalese/Mauritanian hakes

Total effort exerted on this stock was estimated using c.p.u.e. of Portuguese trawlers (Table 1); curves of c.p.u.e. and of corresponding equilibrium yield against estimated total effort were drawn by eye (Fig. 1). According to these data, total effort remained fairly stable over the period 1965-69 at a level of about 350 000 standard hours of fishing. In 1970 and 1971 an increase of fishing effort is observed together with a reduction of c.p.u.e. and of total catch. No c.p.u.e. is available for 1972 but, with the rapid development of U.S.S.R. activities, total catch went up about two-thirds above the 1971 figure, i.e. well above the maximum of the estimated equilibrium yield curve. This increase in catches strongly suggests that fishing effort expanded considerably in 1972 and that, although no further drop in total catch has yet been observed, it is most unlikely that the 1972 catch can be maintained. On the contrary, only a substantial reduction of effort—down to below the 1965-69 level—would ensure in the long run a maximum production of about 30 000 tons.

Table 1

Estimated total catch of Senegalese/Mauritanian hakes, c.p.u.e. of Portuguese trawlers and estimated total effort in Portuguese hours fishing

Year	Total catch ('000 tons)	c.p.u.e. Portugal (kg/h)	Estimated total effort ('000 h)
1965	24.8	70	354
1966	26.6	76	350
1967	32.0	91	352
1968	27.8	89	312
1969	27.7	74	374
1970	23.0	48	479
1971	20.8	59	353

Table 2

Catches and c.p.u.e. of European hake by Moroccan trawlers (Preliminary data)

Year	Catch (tons)	Effort (days fishing x hp x 1 000)	c.p.u.e. $\left(\frac{\text{tons}}{\text{day fishing x hp x 1 000}}\right)$
1959	2 513	944	2.67
1960	1 854	943	1.97
1961	1 948	941	2.07
1962	1 527	942	1.62
1963	2 009	1 185	1.69
1964	2 720	1 380	1.97
1965	2 710	1 182	2.29
1966	3 920	1 200	3.27
1967	3 919	1 507	2.60
1968	3 219	1 569	2.05
1969	2 342	1 589	1.47
1970	4 802	2 022	2.37
1971	2 877	1 783	1.61
1972	2 616	1 669	1.57

Table 3

Summary of available length frequency distribution (% of hakes by species)

COUNTRY	PORTUGAL				BULGARIA		FRANCE		MOROCCO
Origin of data	Commercial				Commercial		Research		Research
Species	Merluccius spp.				M. senegalensis		M. senegalensis	M. cadenati	M. merluccius
Statistical division	34.1.3/34.3.1				34.1.3		34.1.3/34.3.1	34.3.1	34.1.1
Period	1970	Length	Whole year mean 1971	1972	1973	July 1973	August 1973	July 1973	July 1973	Sept. 1973
Midpoint length class		9 cm								4
		11								22
		13								30
		15								42
		17							6	86
18 cm	3									
		19	1					1 2	51	110
		21	3	1				2 7	190	130
22	36									
		23	15	2	1			2 65	153	114
		25	21	4				7 117	56	76
26	140									
		27	42	8	15			16 32	71	50
		29	69	17	75		2	37 51	131	51
30	287									
		31	91	37	100	8	2	80 173	87	57
		33	103	55	66	42	6	204 314	39	48
34	186									
		35	107	70	53	141	57	244 188	16	30
		37	129	71	85	291	194	154 42	38	28
38	133									
		39	73	102	143	251	258	84 6	71	18
		41	82	121	154	157	231	58 1	50	17
42	144									
		43	74	122	126	69	136	50 1	26	20
		45	50	128	70	32	64	35	13	13
46	60									
		47	35	97	43	8	28	11	4	9
		49	26	70	27		6	5		9
50	23									
		51	23	40	15		6	3	1	4
		53	16	19	9			1		3
54	11									
		55	11	10	5		6	1		5
		57	7	8	3					2
58	4									
		59	4	6	2			2		2
		61	4	4	2					
62	1									
		63	2	4	2					2
		65	2	1	1					3
66	1									
		67	2							
		69	2	1						
70										
		71	2	1						
		73	1							
71	1									
		75								
		77	1	1						
Mean length	34.2		37.8	42.1	37.0	37.9	39.6	35.9 31.1	28.3	25.7

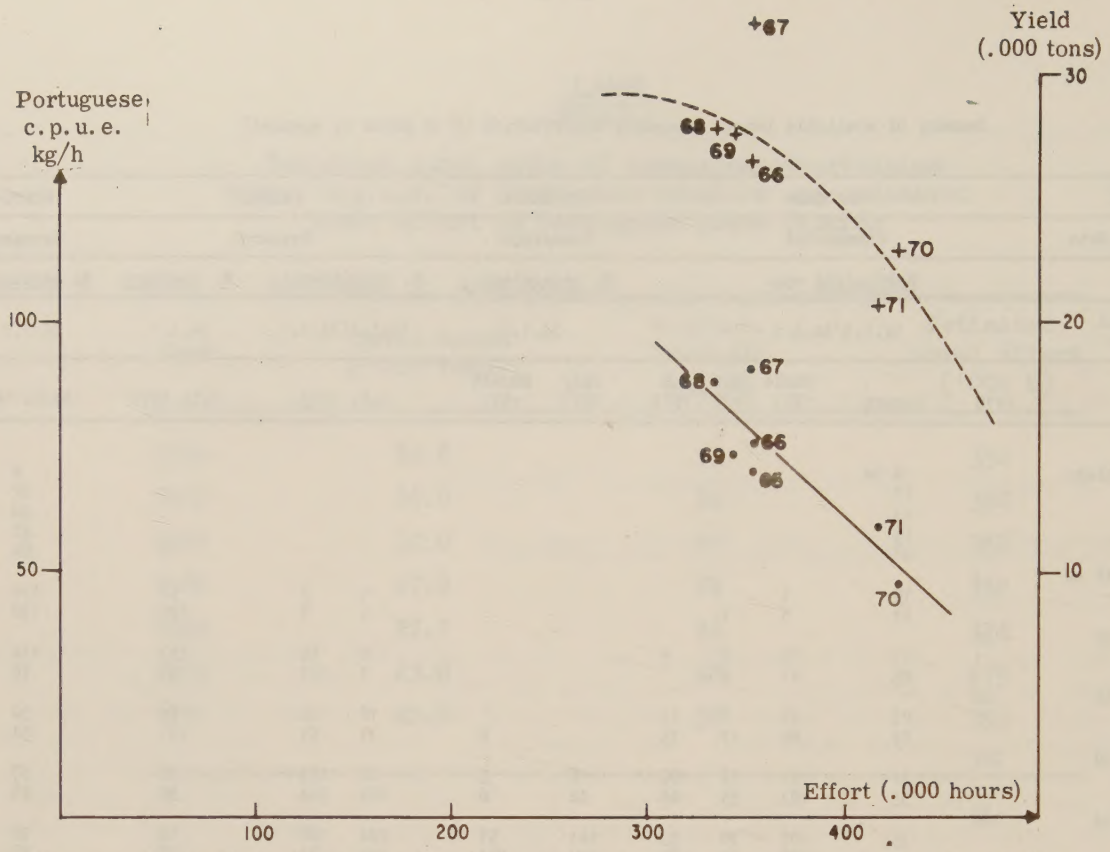

Fig.1 - Senegalese/Mauritanian hakes: Portuguese c.p.u.e., annual catches and estimated equilibrium yield curve against average effort (year of observation and preceding year)

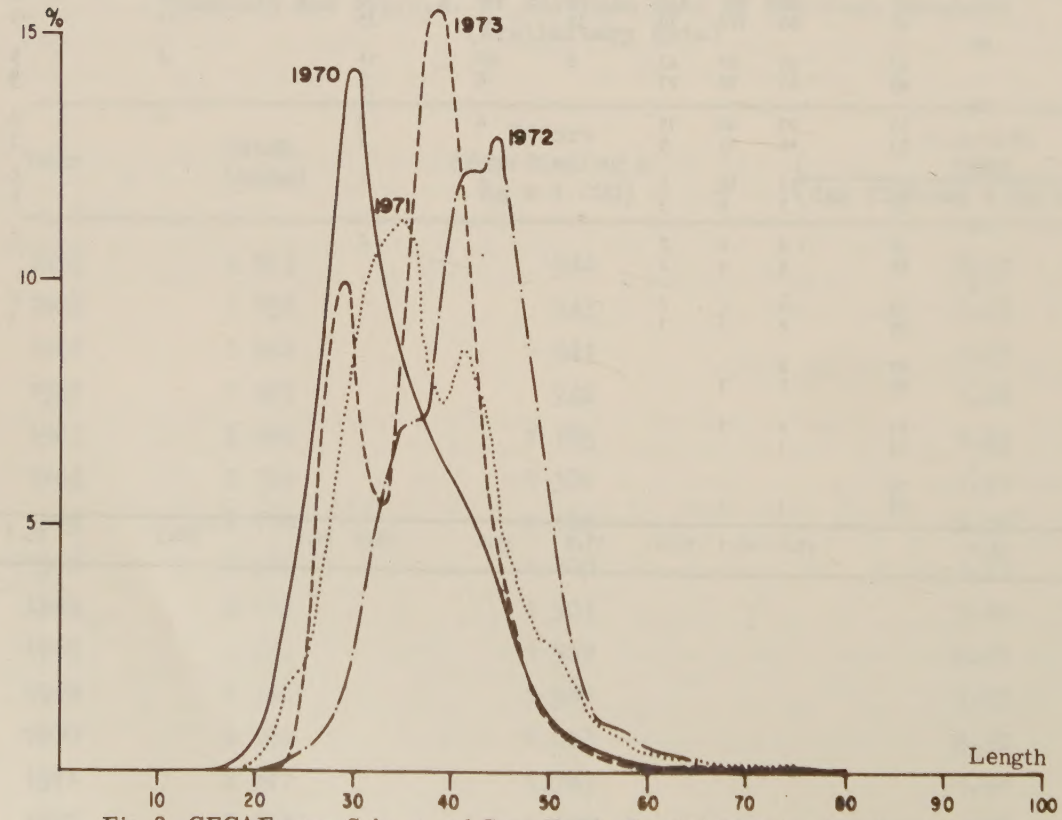

Fig. 2- CECAF area: Sahara and Cape Verde Coastal Division. Merluccius spp, length frequency curves of landings in Lisbon, Portugal

Length frequency distributions collected for hakes (without indication of species) landed in Portugal over a series of four years (Fig. 2) show that the mean length has varied between 30 and 40 cm and that virtually no fish larger than 50 cm are caught. The major part of the catches consists of only 2 to 3 year-classes. The very low abundance of older fish suggests a high rate of exploitation unless large hakes migrate out of the fished area.

From a U.S.S.R. bottom trawling survey carried out in October-November 1972, Domanevsky and Stiopkina[1/] estimated the biomass of Senegalese hake (north of 20°N) at 60 000 tons. This figure corresponds to twice the maximum potential estimated in the previous assessment—if the 1972 catch was about 30 000 tons, this would imply a fishing mortality F = 0.5—a value which appears reasonable though not particularly high. In addition it should be noted that the trawling survey did not cover the whole area of distribution of the stock. This would therefore suggest that the potential could be slightly higher than the figure of 30 000 tons previously obtained.

European hake

Statistics available for the Moroccan fishery show that the Moroccan effort almost doubled during the period 1959-1972 (Table 2), but there is no apparent trend in c.p.u.e. (Fig. 3). The fluctuations observed in c.p.u.e. result probably from year-to-year changes in recruitment since the Moroccan fishery mainly exploits one or two juvenile year-classes on shallow grounds (Table 3).

Moroccan c.p.u.e. data cannot be used as an index of abundance of the whole European hake stock, since they refer only to juvenile year-classes caught in a part of the whole area of distribution of the stock. But the U.S.S.R. trawling survey previously mentioned estimated the total biomass of European hake at 50 000 tons. This figure indicates that the potential for that stock should be well above the present reported catches (3 to 5 000 tons in 1970-72).

Conclusion

Since separation of catches between European and Senegalese/Mauritanian hakes is still not very reliable, another assessment has been attempted using the same method as the one applied to the Senegalese/Mauritanian hakes, i.e. using the Portuguese c.p.u.e. as an index of abundance for all species and pooling catches of all species of hakes together. Such analysis gives a potential estimate of almost 40 000 tons (for a fishing effort corresponding to the 1966 level).

In spite of the limited value of data available and the assumptions which had to be made, the various calculations attempted lead to comparable conclusions. The sum of hake potentials (all species together) would be notably higher than was previously thought, i.e. of the order of 40-45 000 tons. The estimate is increased if more confidence is attached to the findings of the U.S.S.R. trawling survey. The discrepancy between such a figure and the one given in the previous reports of the Working Party (20-25 000 tons) is essentially due to the fact that in earlier estimates Spanish catches were underestimated.

On the basis of data available it can be concluded that the Senegalese/Mauritanian hakes—mainly exploited in the Sahara Coastal Division and in the northern part of the Cape Verde Coastal Division—is fully exploited; a reduction of fishing effort will result in higher catch rates and likely in higher total catches in the long run. On the other hand the European hake—mainly concentrated in the Morocco Coastal Division and to a lesser extent in the Sahara Coastal Division—seems to be underexploited; increased effort would result in higher yields.

1/ Domanevsky, L.N. and H.V. Stiopkina, 1973 The peculiarities of distribution and the first estimation of abundance of the major groundfish on the northwest African shelf. ICES, CM 1973/3

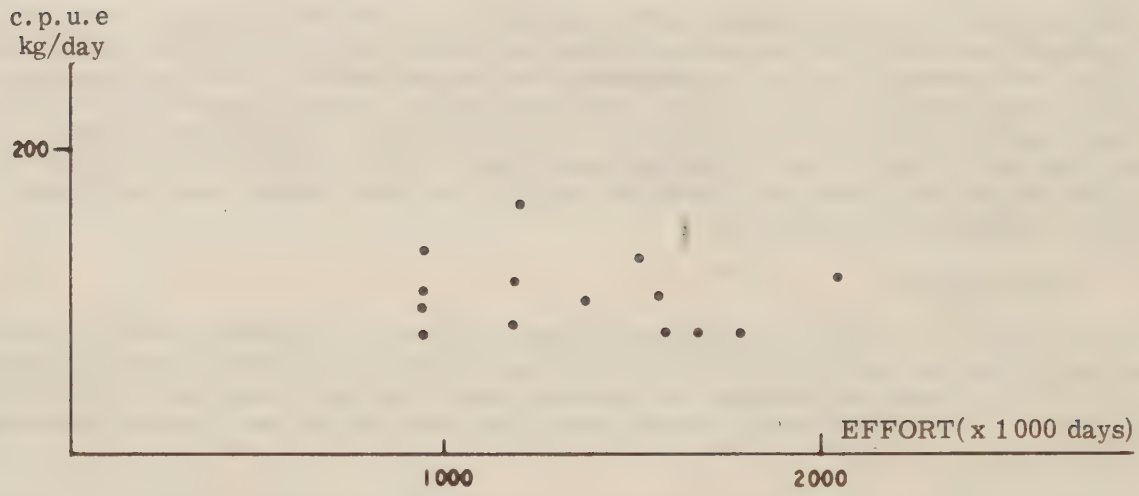

Fig. 3-Morocco c.p.u.e.of European hake against effort during year of observation(effort in units of a 100 hp trawler)

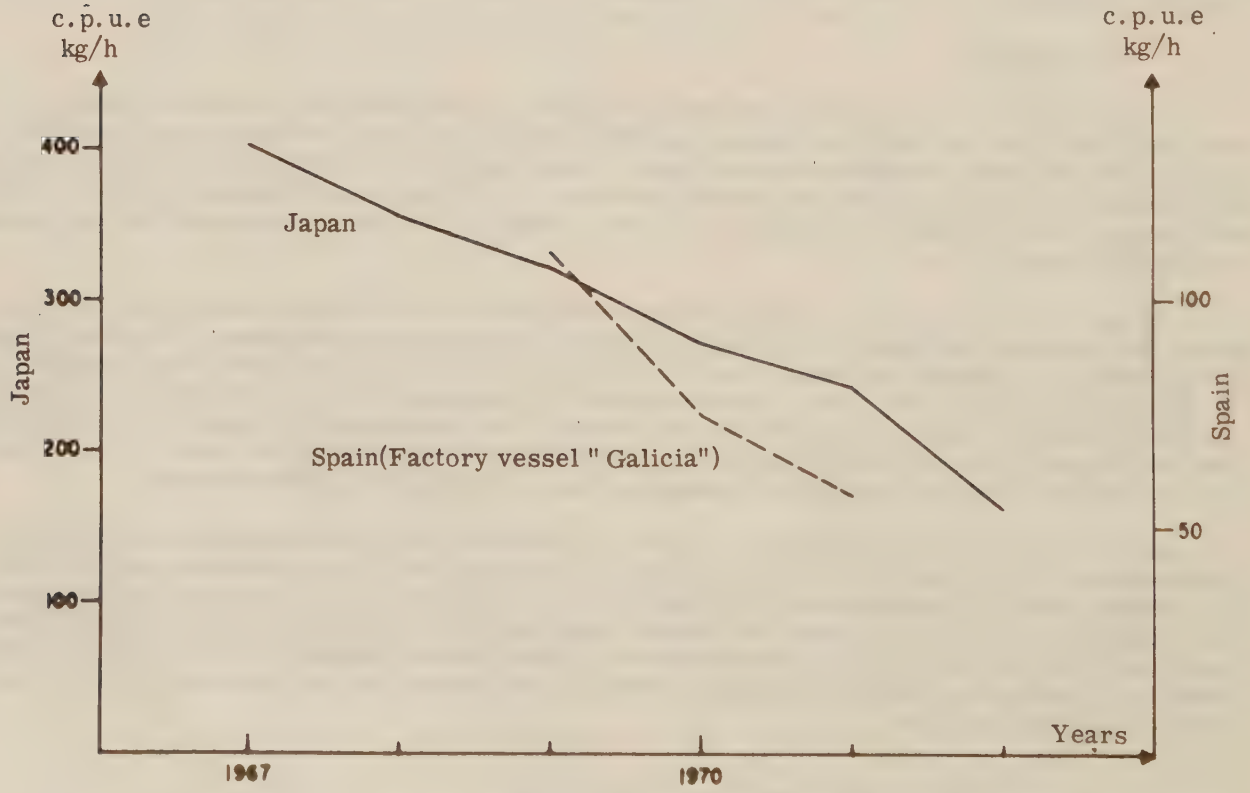

Fig. 4-Cephalopod stocks in Sahara and Cape Verde Coastal Division: c.p.u.e. in the Japanese and Spanish(factory vessel GALICIA) fisheries

Improved assessments of these stocks would only be achieved if better statistics are available, i.e. hake catches—with estimates on species composition—by statistical divisions from all countries fishing for hakes, effort data by divisions, and information on size and age composition of individual species landed.

2.1.2 Sea breams

Sea bream catches in the northern subtropical zone of CECAF gradually increased from 100 000 tons in 1965 to nearly 160 000 tons in 1972 (Table 2, Appendix 3). This group includes many species (Table 3, Appendix 3) but, since several countries do not report their sparid catches by species, the stocks cannot be assessed separately. Only Japan has reported specific data regarding its catches of Pagellus bellotti (Appendices 4, 5 and 6). In Appendix 4, catch, effort and age composition concerning Japanese catches of Pagellus bellotti in the Sahara Coastal Division for the period 1969-72 are analyzed. Because during that period the activity of Japanese large trawlers decreased in comparison with that of medium-size trawlers, indices of abundance of successive year-classes have now been calculated from medium-size trawlers catch rates and therefore are not directly comparable to indices, based on data from large trawlers, presented in earlier sessions of the Working Party; however, estimates of total mortality, derived from the two sets of data separately and from abundance indices of each year-class from its 4th to its 8th year of life, are comparable (Table 4).

Table 4

Estimates of total mortality (Z) derived from Japanese indices of abundance by year-class and year of capture (Sources: period 1963-1970: FID/R109, Appendix 8, Table 6; period 1969-1973: present report, Appendix 4, Table 3)

Year	Age-classes 5/4	6/5	7/6	8/7	Average Z	% of fish less than 4 years old
1964	.22	.51	.56	.40	.42	19
1965	.39	.48	.65	.69	.55	16
1966	.45	.97	.76	.80	.74	16
1967	-	.36	.78	1.16	.91	32
1968	.54	.94	1.11	.99	.90	31
1969	.94	1.39	1.66	1.61	1.40	33/34
1970	.21	.54	.65	.63	.51	15
1971	.76	.65	.48	.37	.56	38
1972	.82	.65	.34	1.11	.73	43
	.54	.72	.78	.91	.75	

Total mortality estimates increase with age, partly because recruitment is not complete at four years. Annual average values of Z increased from 0.42 in 1964 to 1.40 in 1969. The estimate of Z dropped sharply in 1970 and though increasing since then, is, for 1972, still below the 1969 value. Percentages of young fish caught (less than four years old) follow the same trends; however, the percentage of young fish caught in 1972 is higher than the percentage for 1969, during which Z was maximum. If, as trends of Z suggest, the rate of exploitation during the years 1970 to 1972 has been below that of previous years, there should have been in addition a shift of fishing effort towards younger age-classes. It

should also be noted that the 70 mm minimum mesh has been introduced in late 1972; however, its effects, particularly on catches of young fish, are not yet detected.

These series of data are not easy to interpret. In particular it is unclear how the decrease in total mortality has been effected, since, although the Japanese catches of Pagellus bellotti went down from 1969 to 1971[2/], in relation with the general reduction of Japanese catches of sea breams, the total catches for this species group which includes a substantial, and likely fairly stable, proportion of Pagellus bellotti increased by 50% from 1968 to 1972.

If the value of Z (.73) for 1972 is correct, and assuming a natural mortality coefficient of 0.2, fishing mortality during that year (as well as in average during the period under review) would be of 0.55. According to the yield-per-recruit diagram given by I. Ikeda (FID/R109, Appendix 8, Fig. 3), this would correspond to the optimum fishing level for this stock.

Not much can be said about other individual sea bream stocks because necessary data on catch, catch per effort and age composition of commercial catches are lacking. According to Spanish data, the nominal effort of the Spanish fleet remained more or less stable, whereas the catches of sparids dropped. In Table 5, the resultant trend in c.p.u.e. under the assumption of constant effort is presented. Not much value can be attached to the individual figures but the reduction of catch, and hence also the estimated c.p.u.e. to half of its value in 1965, is highly unlikely to have been caused merely by a reduction of total effort and is therefore probably significant.

Table 5

Spanish catches of sea breams in Sahara Coastal Division and estimated c.p.u.e. (assuming a constant effort of 7 500 days per year)

	1965	1966	1967	1968	1969	1970	1971	1972
Catches ('000 tons)	27.7	26.4	19.8	18.0	18.4	14.4	14.4	4.7*
c.p.u.e. (tons/day)	3.7	3.5	2.6	2.4	2.5	1.9	1.9	0.6*

* probably underestimated

An analysis of the effects on the Japanese fishery for cephalopods of changes in mesh size resulting from a reduction of the allowable by-catch of sparids from 20 to 10% was presented by I. Ikeda (Appendix 6). At present the annual average rate of by-catch of sparids amounts to 16% in the Sahara Coastal Division and to 22% in the Cape Verde Division. In areas where such levels of by-catch cannot be reduced with the mesh size at present used in the cephalopod fishery (which is assumed to be somewhere between 30 and 50 mm), a minimum mesh size of 70 mm would have to be introduced if the by-catch rate has to be below 10%. A summary of additional calculations made is given in Table 6.

According to the area of fishing and the assumption made regarding the present mesh size, the immediate loss in weight ranges from 3-25% for cuttlefish and between 15-18% for squid. Not much can be said about octopus catches, since selectivity data available refers only to 31 individuals without reference to size. It should be noted, however, that, because increase in mesh size will result in the loss of smaller animals, the immediate loss in weight, which cannot be calculated, should be smaller than the figure of 45% tentatively given for the loss in number.

2/ but increased again in 1972

Table 6

Effects of changes in mesh size from the present level of 30 mm–50 mm on the catch of cephalopods and sparids by Japanese trawlers

Division	Sahara coastal		Cape Verde coastal	
Present mesh size (assumed)	30 mm	50 mm	30 mm	50 mm
New mesh size	70 mm	70 mm	70 mm	70 mm
CEPHALOPODS - Immediate loss in weight (%)				
cuttlefish	10.7–25.3	7.3–17.8	4.2–8.6	2.9–6.0%
squid	18.2	15.0	size composition not available	
octopus (in numbers*)	(~45	~45	~45	~45%)
SPARIDS**				
Immediate loss	14.7–16.4	13.7–15.3%		
Longterm gain E = .6	(-0.9)–(-1.4)	1.2–2.1%		
E = .8	3.0–4.3	6.2–7.9%		

*numbers can only be considered because of limited data available (cf. Table 5 in Appendix 6)

**estimates based on total length frequency distributions of Japan for 1971 and 1972 separately

Logit functions for selection curves used:

30 mm Z = .3 (Length in cm) - 1.98

50 mm Z = .3 (Length in cm) - 3.30

70 mm Z = .3 (Length in cm) - 4.62

Chance of being retained

$$P = \frac{e^{2Z}}{1 + e^{2Z}}$$

Selection factor = 2.2

Natural mortality is assumed to be .2; T (difference between age at recruitment to new gear and average age of fish released) is assumed to be two years for the increase in mesh size from 30 to 70 mm and one year for 50 to 70 mm); $W = 3.453\ L_{mm}^{2.91} \cdot 10^{-5}$; all length measurements in forklength; mesh assessment according to Gulland, 1969

It is not known how many vessels would have to employ a 70 mm mesh size in case the allowed by-catch of sparid is put at 10% in the fishery for cephalopods. Assuming that half of the vessels would be involved, the immediate loss would be some 2-15% for cuttlefish, 7-9% for squid and maybe below 15% for octopus, i.e. on the basis of the relative importance of species in the catches, approximately 10% of the Japanese cephalopod catches. In addition, the effects on the sparid catch of the adoption of a 70 mm mesh size in the cephalopod fishery were assessed. Most likely there will be only a limited gain (of a few percent) in the sparid yield.

However, immediate loss of cephalopods is not the only factor to be considered for judging the opportunity of introducing mesh size regulation in the cephalopod fishery. Longterm effects on the cephalopod yield is more important. Data presented in Tables 3 and 4 of Appendix 6 were also used for assessing the immediate loss and possible longterm effects on cuttlefish and squid catches resulting from the introduction of a 60 mm mesh size in the fishery for cephalopods. The results of using the Cadima method are set out in Table 7.

Table 7

Effects on cuttlefish and squid catches of change of mesh size in the Japanese fishery for cephalopods

	Change in mesh-size (2 assumptions regarding mesh size used at present)					
	30 mm → 60 mm			50 mm → 60 mm		
	Cuttlefish		Squid	Cuttlefish		Squid
	Sahara	Cape Verde	Sahara	Sahara	Cape Verde	Sahara
Immediate loss	-8%	-7%	-10.5%	-4%	-3%	-6.4%
Longterm gain assuming E = 0.4	+9%	+8%	+13%	+5%	+4%	+7%
0.6	+14%	+12%	+20%	+7%	+6%	+11%
0.8	+18%	+17%	+28%	+10%	+8%	+15%

According to these calculations the immediate loss would be around 5%. The longterm effects are more difficult to assess. The evaluation made indicates that there would be a longterm gain of around 10%; however, this finding may not be valid since the method used for assessing the longterm effects assumes that natural mortality remains constant throughout the life span of the species. This hypothesis may be incorrect for cephalopods for which natural mortality may increase very rapidly after spawning. (They are said to spawn only once during their life-span).

New selectivity data for Pagellus bellotti were made available by France (Appendix 9). The selection factor of 2.8 thus obtained cannot be directly compared with the value of 2.2 estimated by Japan, because of differences in fish measurement (forklength for Japan and total length for France).

2.1.3 Cephalopods

According to statistics available (Table 4, Appendix 3) the total catch of cephalopods reached a maximum of 155 000 tons in 1967-68, then declined to 96 000 tons in 1971 and again sharply increased to 170 000 tons in 1972. This recent rise only concerns Spanish catches and is very unlikely related to an expansion of the Spanish fishery which is known to have remained fairly stable during the whole period. It rather reflects recent improve-

ment in the reporting of Spanish statistics. Therefore, to arrive at more valid nominal catch figures, some 40-50 000 tons would have to be added for Spain and for years prior to 1972. In addition, no information is available on catches from Greece and Italy, two countries which are believed to fish for cephalopods in the area. Actual catches could be still higher by some 10-20%.

From detailed information provided by major fishing countries, 80-90% of catches are taken off Spanish Sahara (Sahara Coastal Division). The remaining part mainly comes from the northern area of the Cape Verde Coastal Division. No stock of significant importance seems to be available in the Morocco Coastal Division. Catches as a whole consist of octopus (about one-third), cuttle fish (20%) and squid (15%) but there are substantial differences in the species composition of catches made by respective countries. Mesh size used ranges from 30-50 mm for small Japanese trawlers and 40 mm for Spanish vessels to 70 mm for large Japanese trawlers.

An analysis based on Japanese catch and effort statistics was presented to the session (Appendix 4). The general trend in the state of the cephalopod stocks can be derived by dividing total Japanese catches by the total nominal, uncorrected, Japanese effort (Table 8). In addition rough estimates of Spanish c.p.u.e., based on catch rates obtained by that part of the Spanish fleet fishing for the factory vessel GALICIA, were available (Table 9). According to data presented in Table 8, the total Japanese effort has remained stable. The same observation applies to species composition of catches, thus indicating that no major shift in species sought has occurred. The size of the Spanish fleet operating in the area is also known to have not significantly changed over the period considered. As Spanish and Japanese catches represent more than 80% of total yield of cephalopods, it can be concluded that overall effort exerted on that stock should have also remained fairly stable: however, both sets of c.p.u.e. show a considerable drop (of 60% from 1967 to 1972), according to Japanese data (Fig. 4). This reduction in abundance, which apparently was not due to increased effort, may result from some particularities in the biology of cephalopods which are known to have relatively short lifespans (about one year for octopus and squid, and two years for cuttlefish) and lay only once in their life a small number of eggs which may be vulnerable to trawling operations. C.p.u.e. would then reflect relative strength of successive recruitments and the drop in catch rates would indicate that the level of recruitment has been continuously decreasing during the whole period.

Table 8

Japanese cephalopod fishery: total effort (uncorrected), total catch and c.p.u.e. by years

Year	Effort ('000 h)	Cephalopod catch ('000 tons)	c.p.u.e. (kg/h)	% of cephalopods in total catch
1967	236	95.2	404	56
1968	274	97.7	356	53
1969	265	85.4	322	49
1970	255	69.9	273	49
1971	241	59.1	245	52
1972	291	47.6	164	43

Table 9

Spanish fleet GALICIA operating in the Sahara Coastal Division: catch, effort and c.p.u.e. by year

	1969	1970	1971	1972
Total catch ('000 tons)	53.6	45.0	F 48.0	112.2
Factory vessel catch (½ total catch)	26.8	22.5	F 24.0	(56.1)
No. of boats (250 hp) operating for GALICIA	40	50	70	(70)
C.p.u.e. (kg/h)	111	75	57	(133)

F = estimated
( ) = not reliable

Specific analysis of the state of the various stocks, based on data presented in Appendix 4, gives a more complicated picture. Indices of abundances as derived from Japanese c.p.u.e. have been plotted against total uncorrected (Japanese c.p.u.e. x total reported catch) effort and c.p.u.e. curves were drawn by eye (Table 10 and Fig. 5). Corresponding yield curves give maxima of about 40 000 tons for cuttlefish and 110 000 tons for octopus. Squid maximum yield is more difficult to estimate from available data, but it does not seem that increased effort would result in bigger catches.

These analyses are difficult to interpret in terms of maximum potentials. On the one hand, the yield curves and their respective maxima are obviously too low since total catch, and total effort derived from it, does not include the unreported part of Spanish catches as well as the Italian and Greek catches. After the session, additional calculations were made, according to various assumptions, in order to assess how the fishing effort corresponding to unreported catches may affect the present calculations. They are given in Appendix 8.

On the other hand, and as already mentioned, recruitment may well have significantly decreased in comparison with the initial situation before the fishery expanded. If this is the case, e.g. if reduction in recruitment is partly related to fishing effort, it would not be possible to maintain the present catches. In any case, there is little doubt that no increase in total catch can be expected in the long run from increased effort, and most likely fishing effort is beyond the optimum level.

Special attention has been paid to changes in mesh sizes. At the Third Session of CECAF (see report FID/R132) a minimum mesh size of 60 mm for the cephalopod fishery was recommended more or less arbitrarily, but with the purpose of protecting young sparids caught when fishing for cephalopods. Additional data on selectivity for squid and cuttlefish (Appendix 6) and length distributions of cuttlefish and squid in Japanese catches (Appendices 5 and 6) have become available; however, virtually no information is available about selectivity for octopus as well as on growth and natural mortality of cephalopods in general. Therefore, no conclusion can yet be drawn about the optimum size or age at first capture and, thus, no optimum mesh size to be used in the cephalopod fishery can be advised. Analysis of the effects of changes in mesh size from 30 mm and 50 mm to 60 mm and 70 mm and summaries of expected immediate losses in weight and possible longterm gains have been already given in Tables 6 and 7 of the present report. From data available, no reliable estimate of such effects can be given for octopus which is the most important species. For cuttlefish and squid, an increase in mesh size to 60 mm will only have a limited

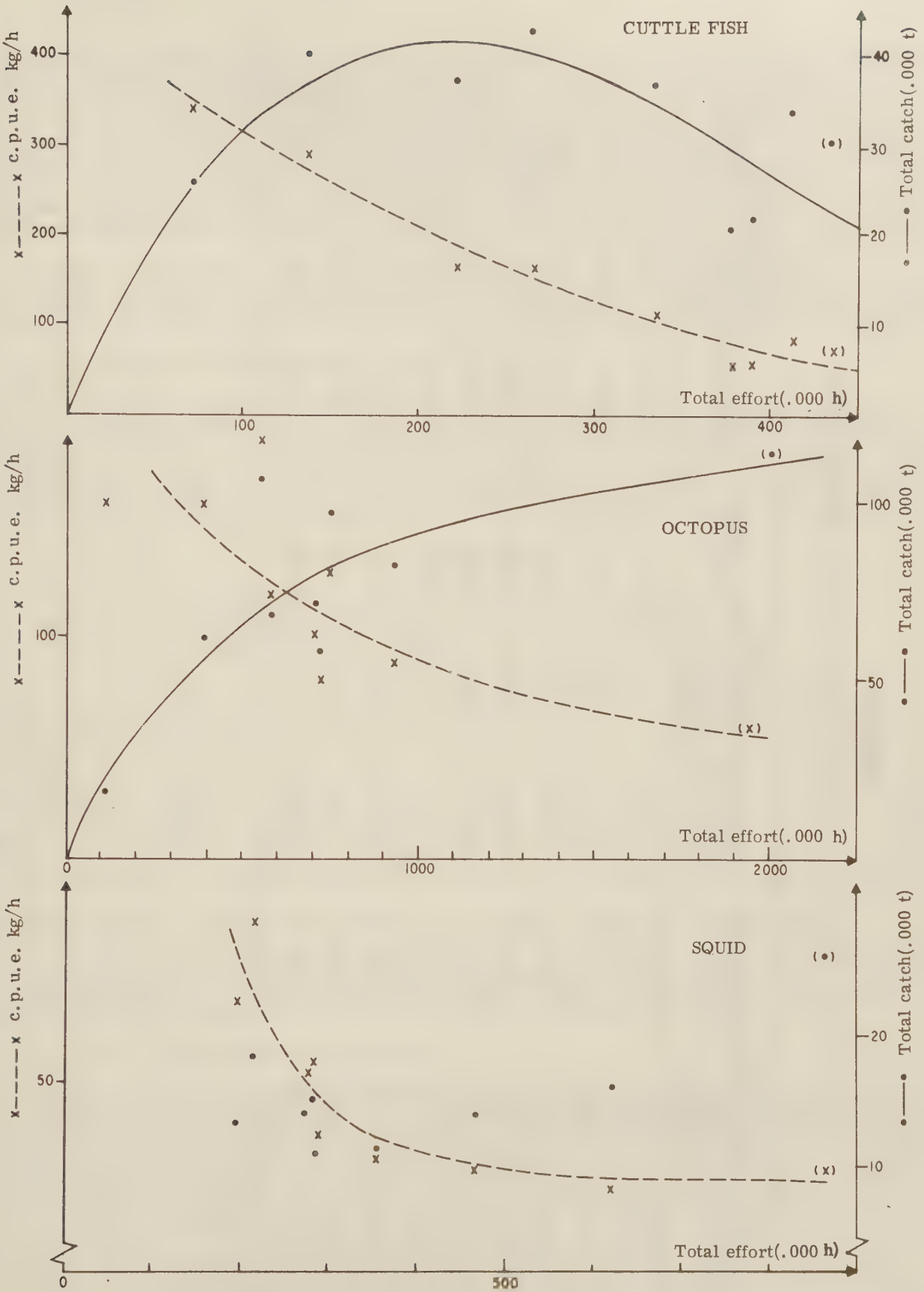

Fig. 5- Cephalopod fishery: Japanese c.p.u.e. and total catch against total effort. (•) 1972 figure

Table 10

Total catch, Japanese c.p.u.e. and estimated total uncorrected effort

	Cuttlefish			Octopus			Squid		
	Total catch ('000 tons)	Japanese c.p.u.e. (kg/h)	Total effort ('000 h)	Total catch ('000 tons)	Japanese c.p.u.e. (kg/h)	Total effort ('000 h)	Total catch ('000 tons)	Japanese c.p.u.e. (kg/h)	Total effort ('000 h)
1964	25.8	348	74	18.9	161	117	18.5	86	215
1965	40.1	291	138	69.3	119	582	13.4	68	197
1966	37.1	167	222	62.4	160	390	11.0	38	289
1967	42.9	162	265	97.3	130	748	14.3	52	275
1968	36.8	110	335	107.1	189	567	11.7	33	355
1969	33.9	82	413	82.5	89	927	16.1	26	619
1970	20.8	55	378	71.3	101	706	14.0	30	467
1971	21.8	56	389	58.7	81	725	15.3	54	283
1972	30.5	70	436	114.7	59	1 944	25.9	30	863

immediate effect (about 5% loss), but further increase to 70 mm would result in a more substantial drop (about -10%) in catches. The longterm effect, as stated in section 2.1.2, cannot be ascertained with information available at present. Thus, although a mesh size of 60 mm for cephalopods does not appear harmful for the exploitation of cuttlefish and squid, there remain doubts about effects on catches of octopus which are known to crawl through relatively small mesh size. The Working Party therefore strongly recommends that investigations be rapidly undertaken on selectivity for octopus; also more detailed growth data and estimates of natural mortality for all species are urgently needed. Without such information no precise recommendation on mesh size to be used in the cephalopod fishery can be advised.

Another important question to be investigated remains the possible effects of damage to the eggs, and therefore to recruitment, by trawling. It is reiterated here that, because of their low fecundity, stock/recruitment relationships in these stocks may be crucial.

2.2 Northern subtropical area: pelagic resources

As has been described in the report of the previous session of the Working Party, the industrial fisheries for pelagic species has rapidly developed in the area since 1969. The estimated catches by trawl and by purse seine are given in Table 11 (revised figures based on official statistics and information supplied to the Working Party). The trawl catches have increased over the period 1965-1969 and remained fairly stable from 1969 onward, whereas the purse seine fishery developed rapidly in 1969 and 1970 and stabilized thereafter.

Table 11

Total catches (in '000 of tons) of pelagic species (excluding European sardine) in the transitional zone (Sahara and Cape Verde Divisions) by trawl and purse seine

Catch	1965	1966	1967	1968	1969	1970	1971	1972
Trawling	106.8	79.7	172.4	252.0	430.5	371.1	348.8	401.9
Purse seining	46.6	32.2	53.5	39.9	230.7	807.1	815.2	789.9
Total	153.4	111.9	225.9	291.9	661.2	1 178.2	1 164.0	1 191.8

The total catches by both gears together have remained stable from 1970 onwards.

No detailed statistics are available of the catch by species but it has been possible to make rough estimates of the species composition. Table 5 in Appendix 3 provides the data on catches by species for the two main gears, separately and together.

2.2.1 Horse mackerel and mackerel

Data on catch per day fishing are available for some countries and years. Estimates of the U.S.S.R. and Bulgarian catch per day of large freezer trawlers of about 3 000 hp together covered the period 1965-73, and Polish data of freezer trawlers of about 1 600 hp are available for 1967-73. Fig. 6 illustrates that, whereas the total catch of mackerel and horse mackerel together, by all gears, increased from about 100 000 tons in 1965 to 700 000 tons in 1973, the catch per day fishing of these two types of trawlers did not show any clear trend downwards, although the large trawlers gave relatively low figures for the last three years. It should, however, be taken into account that the efficiency of the vessels may have substantially increased during this period, e.g. the gear used in the years until 1968 was a high-opening bottom trawl but from 1969 onwards an increasing part of the fleet employed more efficient pelagic trawls. It may, therefore, be assumed that

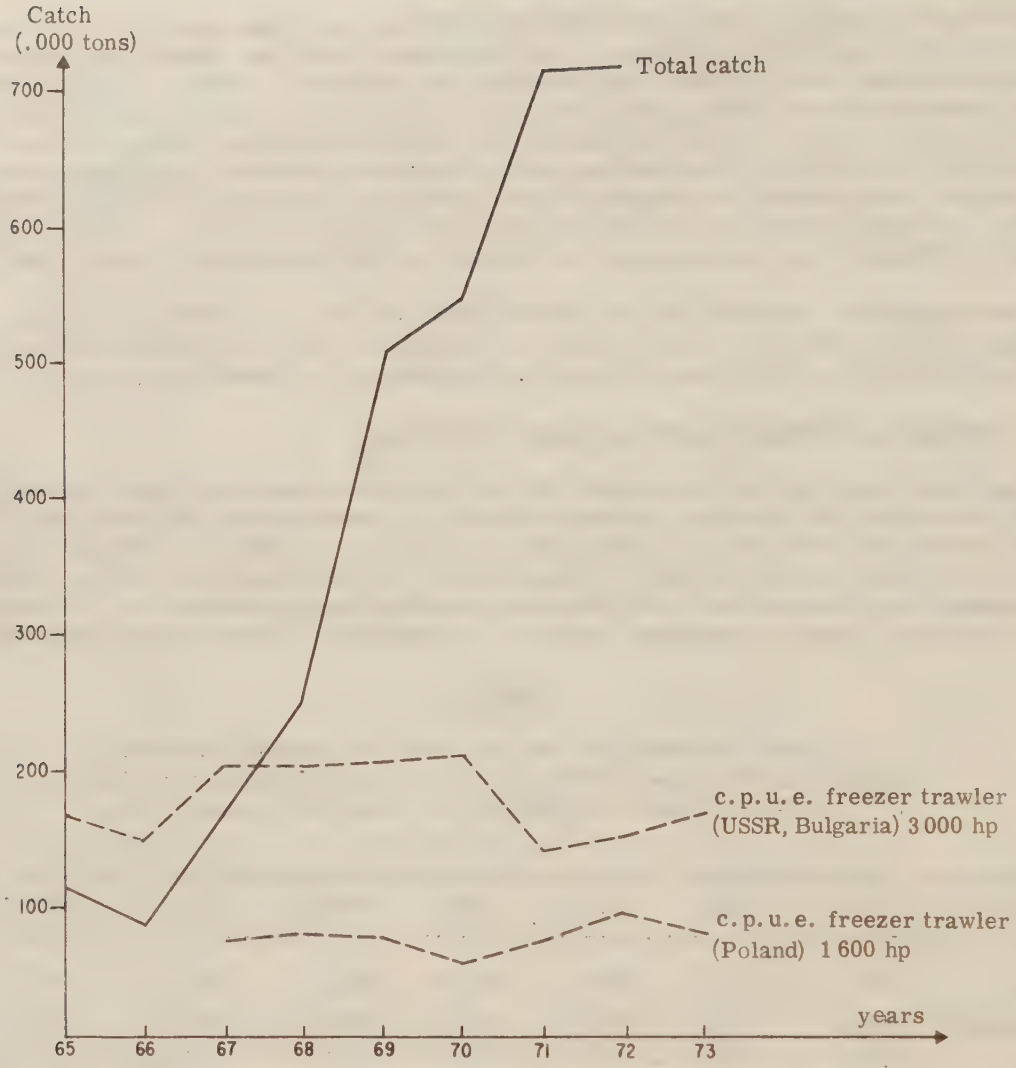

Fig. 6- Total catch of mackerel and horse mackerel together and catch per day fishing of two types of freezer trawlers

Fig. 7-European sardine: annual catches for Morocco and other countries.
(•) preliminary estimates

the fish density has decreased more than the figures of catch per effort, and hence that the effective fishing effort has increased more than the nominal effort calculated by dividing the total catch by the catch per unit effort data. The proportion of the different species in the catches showed fluctuations from year to year but remained roughly at the same level (Table 12).

The available data are not sufficient to obtain reliable estimates of relative fish density and effective effort, and hence to estimate the state of exploitation of the stocks and their potential yield.

Data on changes in size composition of the catches could provide further indication of the effects of fishing. The data available to the Working Party, however, referred to some countries and years only, and were insufficient for a more detailed analysis. More complete reporting of available size composition data is required.

Table 12

Proportion of the three pelagic species in the trawl catches

Species	1965	1966	1967	1968	1969	1970	1971	1972
Sardinella	1	10	4	11	14	7	7	7
Horse mackerel	47	45	57	65	49	48	55	56
Mackerels	52	45	38	25	38	45	38	37
Total	100	100	100	100	100	100	100	100

2.2.2 Sardinella

The catches of sardinella showed a sudden increase in the years 1969 and 1970 with the introduction of the industrial purse seine fishery, and stabilized in 1971 and 1972 at a level below that in 1970 due to a reduction in the fishing effort caused by withdrawal from the area of one of the factory expeditions (Table 5, Appendix 3). Some data are available on the catch per day fishing of the industrial purse seine fishery (see Appendix 7) but the sudden start of the fishery at a high and thereafter fairly constant level, together with the short period over which data are available and the increasing experience of the fleets, do not allow any evaluation of the effects of fishing. The reduction in the catch per unit effort in the Senegalese purse-seine fishery, before development of the large industrial fishery began, has been discussed in the Working Party's previous report.

Acoustic survey

A quantitative acoustic survey has been carried out, in the area between 11° and 17°N, in March-April 1973. It was estimated from this survey that the total standing stock of all pelagic fish in this area amounted to 2 million tons south of Dakar until 11°N, and 0.5 million tons north of Dakar until 16°50'N. It should be taken into account that other important concentrations were simultaneously exploited in the areas further north off Mauritania and Spanish Sahara. This would indicate that the total biomass in the whole area could be substantially higher—perhaps double. Taking also into account that the fishery catches a large amount and that, therefore, the standing stock is well below its virgin abundance, these observations would suggest that the total potential of the pelagic stocks, and in particular the sardinella, amounting to perhaps one-fifth or one-fourth of the virgin standing stock size, is higher than the present catches. More extensive data from the whole area are required to confirm this conclusion.

2.2.3 Sardine (pilchard)

Sardines are found in coastal waters with a depth down to 150 m, but mainly in waters of 25-70 m depth, along the coasts of Morocco, Spanish Sahara and Mauritania. The landings in the period 1965-1973 are shown in Fig. 7 and Table 6 of Appendix 3. The total catches during this period have shown tendency to increase, with a peak in 1966 and an estimate of very high catches in 1973. The increasing trend has mainly been due to catches by foreign vessels fishing in the area, which rose gradually from 18 000 tons in 1965 to an estimated 100 000 tons in 1973.

The major part of the catches is harvested by the Moroccan fleet. As has been shown in the report of the previous meeting, the total Moroccan effort in these ports has fluctuated around a fairly constant level of about 1 000 units in the period 1965-1969, after which it rose to about 1 300 units in 1970. The Moroccan effort in 1972 was slightly below that in 1970. The total Moroccan catches remained at about the same level during most of this period but showed a peak in 1966 and again in 1973 (provisional estimate). The peak in 1966 has been attributed to variations in the abundance of the sardine, probably related with year-class strength and with variations in distribution and availability. No information has become available so far whether the high catches in 1973 were due to unusually high abundance or to concentration of the fish in the fishing area. The fleet in 1973 was about equal to that in the previous years. It was reported to the Working Party, however, both that the catches per trip were high and that the number of trips had increased substantially.

The data presently available do not allow estimations of the potential yield of the stocks or the optimum level of fishing. Some other observations may, however, be of relevance. The Moroccan fleet is located mainly in three ports (Safi, Essaouira and Agadir). The great majority of the vessels fish within some tens of miles from the port. Only few freezing vessels can go farther away into more southern waters and their catch is only a small fraction of the total Moroccan landings. Recent exploratory surveys have shown large concentrations of fish along this southern part of the Moroccan coast, both in August, during the main fishing season, and in November, at the end of this season. Whereas it is believed that the fish have a north-south migration which brings them in the neighbourhood of the fishing ports, when the major fishery takes place, it would seem from the occurrence of large fish concentrations along the southern part of the Moroccan coast during the main fishing period that only part of the existing stock or stocks is being exploited.

Nothing is known of the existence of different stocks in the southern area, or of changes in migrations with the age of this fish. It should be noted, however, that it has been reported that the catches of foreign fleets, fishing mainly in the area off Spanish Sahara, consist of much bigger fish than that caught by the Moroccan fleet. Whereas the length composition of the sardine catches of Polish trawlers often show a peak at about 23 cm, with fishes up to 30 cm length, the mode in the Moroccan landings lies around 17 cm, with some fishes up to 21 cm.

Further, quantitative surveys in different seasons would greatly contribute to the knowledge of the distribution, migration, stock size and potential yield of the sardine stocks.

2.2.4 Trumpet fish (Macrorhamphosus spp.)

Large hauls of trumpet fish are sometimes made by commercial trawlers and seiners in the area between Casablanca and southern Morocco and in water of depths between 50 and 250 m. The exploratory survey held in August 1973 located substantial concentrations of this shoaling species in the area above depths of 370-1 100 m. The survey results suggest that the magnitude of the resource could well be greater than that of sardine. Daily vertical migrations make the fish accessible to both trawls and seines. The species is accidentally caught in the present fishery but is so far only little exploited commercially.

2.3 Tropical area

In the tropical area (from Guinea Bissão to Zaire), most fishing, both for demersal and pelagic species, is done by coastal countries. It is only in the northern part of this area (north of 9°N latitude) and during certain seasons that long-distance fleets registered in countries from outside the area operate. In addition, most coastal countries of the Gulf of Guinea exploit exclusively the tropical area of CECAF. Only Ghana fishes appreciable quantities outside this area. Therefore, the production of the tropical area as a whole should be very close to quantities of marine fish landed by coastal countries of the Gulf of Guinea, and changes occurring in the rate of exploitation of tropical stocks could be monitored through variations in production of marine fish made by the countries bordering the Gulf of Guinea.

Despite the relatively low abundance of fish resources in that area, total catches made by coastal countries from Gambia to Zaire in the CECAF region have steadily increased. Their rate of development during the period 1965-72 was about twice higher (+91%) than that of coastal countries from Senegal to Morocco (+45%). These two groups of countries now catch similar quantities of fish (489 000 tons for the southern countries and 471 000 tons for the northern ones in 1972) in the CECAF region (Fig. 8). In the tropical area, the increase in total catches has been more rapid in the last few years; the annual rate of development exceeded 10% after 1969 and reached 18% and 14% for the periods 1970-71 and 1971-72 respectively. Although there are some slight differences between countries, this pattern is observed almost everywhere. This increase in production results partly from an expansion of traditional fisheries off the shores of the respective countries, but also from a better distribution of fishing effort within this tropical area. Countries which already operate long-distance fleets (e.g. Ivory Coast) are intensifying the exploitation of larger resources occurring in the northern part of the Gulf of Guinea. Prospects for developing pelagic fisheries in the southernmost part of CECAF are promising; however, more coastal countries of the tropical area are developing or beginning to develop fishing operations outside the area. After Ghana and Cameroon, Nigeria has recently decided to establish a national company for long-distance fishing.

This expansion of fishing in the tropical area has been common to most of the stocks: e.g. sardinella and bonga, shrimp (mostly P. duorarum) (Fig. 9). Catches of croakers have remained more stable. While fisheries on demersal stocks, including pink shrimp, develop steadily, pelagic fisheries on sardinella and mackerel can be markedly affected by year to year fluctuations in year-class strength and availability. This is particularly the case off Ghana and Ivory Coast (see paragraph 2.3.1).

Table 13 summarizes information available on the marine resources potentials and their state of exploitation. This table also includes information for the northern area of the CECAF region. The existing information is presented by area (as indicated by the names of countries in the first column) and by kinds of resources (as indicated in the first row). For stocks which are widely distributed or mobile, the estimates have not been divided by countries but refer to the whole area of distribution of each of the resources concerned. When, on the other hand, resources are sedentary, e.g. demersal resources in the tropical area, existing information is set out by stretches of continental shelf bordering each coastal country.

Information presented in this table shows that, although in several areas available resources are already highly or fully exploited (e.g. demersal fish stocks off Ivory Coast, Ghana, Nigeria, Congo; pink shrimp stocks off Senegal, Ivory Coast and probably a few other countries), there is still the possibility of expansion of fishing. The best opportunities are offered by coastal pelagic stocks (sardinella, horse mackerel and mackerel) occurring both in the northern part of the tropical area of CECAF (from Sierra Leone to Senegal) and in the southern part (south of Cape Lopez, Gabon). The existence of large stocks of sardinella off southern Gabon and Congo has recently been confirmed by the findings of the UNDP/FAO Project in Congo, subcontracted to the ORSTOM Laboratory in Pointe-Noire.

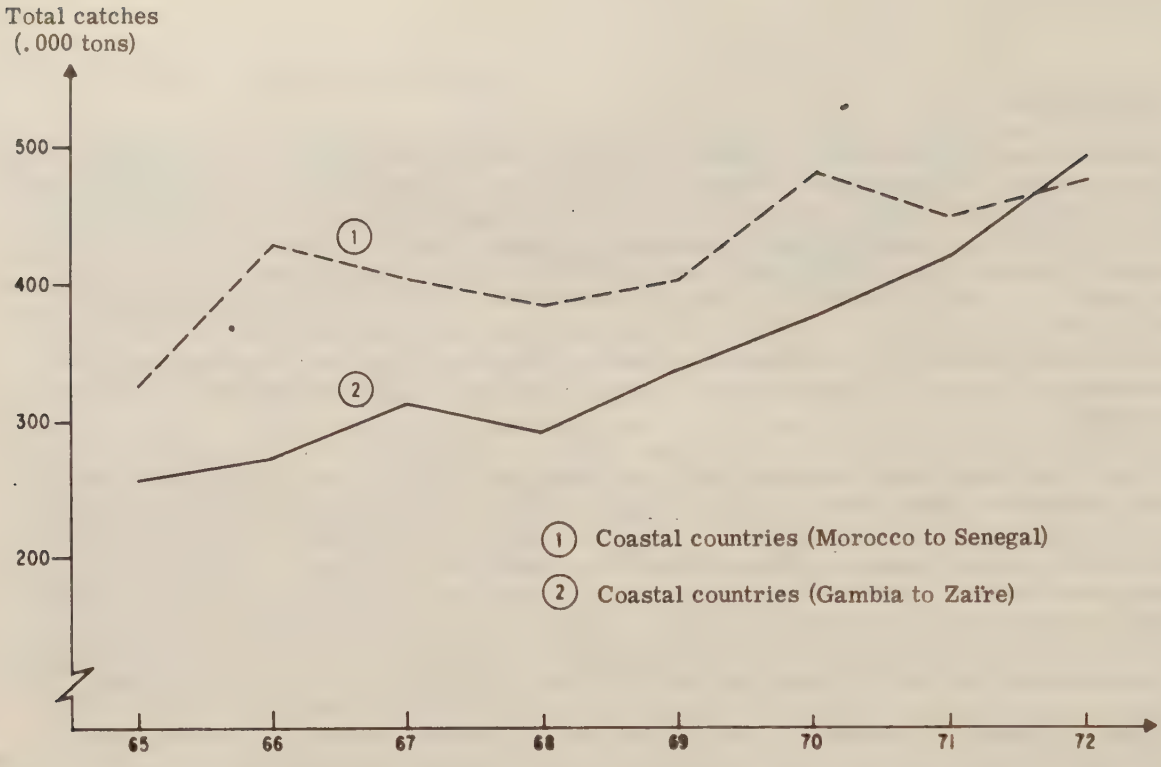

Fig. 8-Annual catches by northern and southern coastal countries in the CECAF region

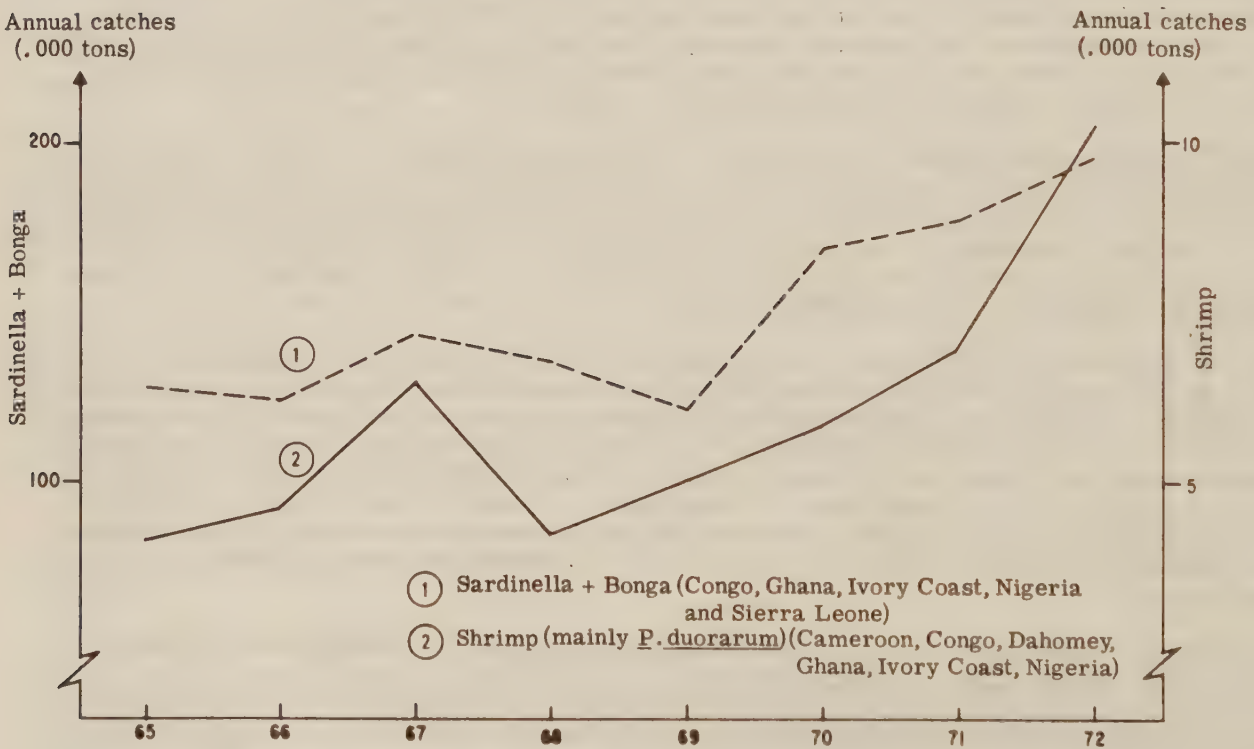

Fig. 9-Annual catches of major producing countries in the tropical area of the CECAF region

Table 13

West African marine resource potentials and state of exploitation

	total potential	DEMERSAL			PELAGIC	
		SHRIMP *	INSHORE (0–50 m)	OFFSHORE (50–120 m)	INSHORE	OFFSHORE
Morocco	>2 million tons	potential and catches unknown	total potential: 500,000–750,000 t several major stocks (hake, sparids, cephalopods) fully or overexploited; smaller inshore stocks still moderately exploited		European sardine potential: few hundred thousand tons; present catches: 400,000 t – probably not fully exploited	
Spanish Sahara						
Mauritania						
Senegal		potential: 2–2,500 t Senegalese catches (1971): 1,500 t			potential (sardinellas, horse-mackerel, mackerel) 1.5–2.00 million t (?) catches (1971): 1.4 million t (< 200,000 t by coastal countries); + inshore stocks (flat sardinella, bonga): potential unknown; moderately exploited	
Gambia						
Portuguese Guinea						
Guinea		potential and catches unknown	potentials not precisely known; moderately exploited	potentials not precisely known (smaller than inshore stocks) – moderately exploited		
Sierra Leone		potential unknown; catches (1971): Senegal 500 t, Liberia?				
Liberia		potential and catches unknown			small stocks (e.g. bonga) moderately exploited	Atlantic tuna fishery: total potential: 0.5 million t yellowfin: potential: 90,000 t catches (1972) 99,000 t fully exploited. bigeye tuna: potential unknown catches (1972): 27,000 t. skipjack: potential unknown catches (1972) 75,000 t moderately exploited
Ivory Coast	1 million tons	potential: about 1,000 t; catches (1972): 870 t	potential: 9,000 t (8t/mil.^{2}); fully exploited	potential: few thousand tons – lightly exploited	sardinellas: 50,000 or slightly above – fully exploited mackerel: about 100,000 t moderately exploited anchovy: unknown; lightly exploited	
Ghana		potential: some hundreds of tons; moderately exploited	potential: about 10,000 t; highly exploited	potential: unknown (but smaller than inshore) – moderately exploited		
Togo		potential unknown	potential not precisely known; highly exploited			
Dahomey		highly exploited				
Nigeria		potential >2,500t(?) catches (1972): 1,400 t	potential: (7 t/miles^2); highly exploited		small stocks of flat sardinella; and bonga; potential unknown; moderately exploited	
Cameroon		potential unknown; highly exploited	productivity similar as in Nigeria; highly (north) or moderately (south) exploited	potentials unknown but small; lightly or unexploited		
Equatorial Africa		potential: few hundred tons; lightly exploited				
Gabon					large stocks of sardinellas, potential unknown, lightly exploited (except off Angola)	
Congo		very small stock; no special exploitation	potential < 9,000t; fully exploited			

* Pink shrimp resources only; deep sea prawns of importance in the northern and southern parts, excluded.

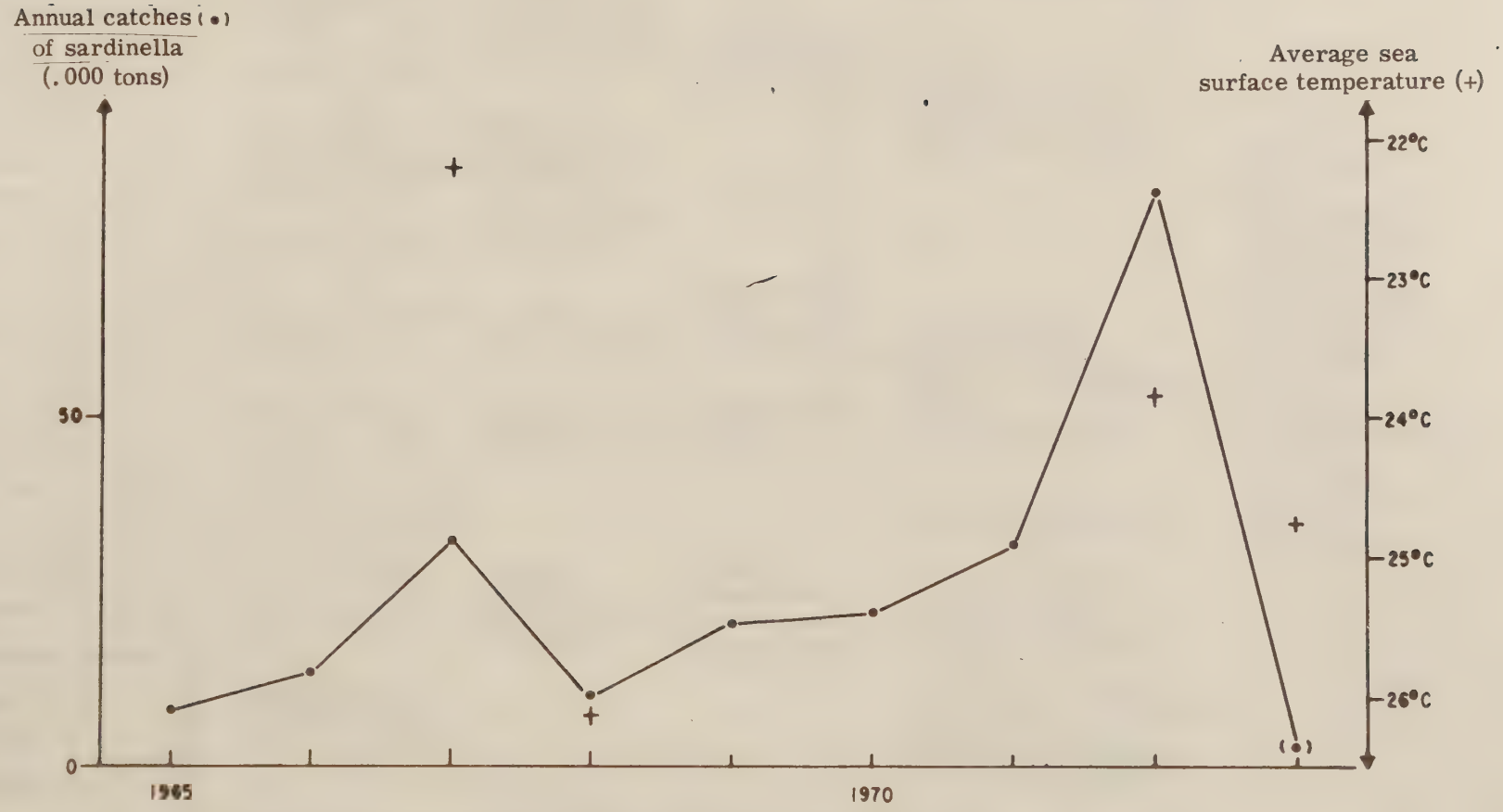

Fig. 10- Ghana:catches of sardinella (mostly S. aurita) and average sea surface temperature at Tema during the fishing season (1/6-31/10)

Offshore demersal stocks are still lightly exploited but development of their fishing is hampered by relatively low catch rates, which will require introduction of more efficient gear, and by unit value of species which is as a whole lower than that of inshore demersal stocks.

Recent data made available to the Working Party confirmed the conclusions presented in the previous reports. Only for a few fisheries was the Working Party able to draw specific additional conclusions from the data it had at its disposal.

2.3.1 Pelagic stocks

Ghana/Ivory Coast

Recently the UNDP/FAO Project in Ivory Coast arrived at the following conclusions regarding potentials of coastal pelagic stocks occurring off Ivory Coast and Ghana: round and flat sardinella are fully exploited while other stocks (e.g. mackerel, anchovy) can support further expansion of fishing (Table 14). The Project also recommended that management measures be introduced in the Ivorian sardinella fishery (the number of purse seiners should be limited to 17-20).

Table 14

Potentials of major coastal pelagic stocks off Ghana and Ivory Coast

Area of distribution	Stocks	Potential (tons)
Ivory Coast	Flat sardinella	10 000
Ivory Coast	Brachydeuterus auritus	10 000 (?)
Ghana/Ivory Coast	Round sardinella	30 000 or slightly above
Ghana/Ivory Coast	Mackerel	50 000 or more
	Anchovy	40 000 (?)

The success of the sardinella fishery, and to a lesser extent of mackerel, in this area depends largely on the timing and strength of coastal and seasonal upwelling. Annual catches made by the Ghanaian and Ivorian boats vary in relation to intensity and duration of this upwelling. Fish which winter near the bottom over the deepest part of the shelf move, at the beginning of the upwelling season, along the bottom towards the shore. During the upwelling, fish shoal in the shallow coastal waters. In 1968 and 1973 the upwelling was particularly weak, while 1967 and 1972 were good upwelling years. These fluctuations in the environment strongly affected availability of fish and possibly year-class strength and therefore annual catches, as can be seen in Fig. 10; however, the very good catches made in 1972 when upwelling conditions were excellent may have reduced the round sardinella stock below its level of maximum production, since catches in 1973 were lower than in 1968 when upwelling conditions were the worst.

Congo

The main conclusion drawn by the UNDP/FAO Project in Congo was that the present Congolese production of sardinella can be expanded by several times, provided that present constraints resulting from limitations in distribution and marketing of fish can be overcome.

Already catches made by local purse seiners, which have remained below 3 000 tons until 1971, reached 7 000 tons in 1972. In addition, about 4 000 tons are caught by the artisanal fishery which is developing rather rapidly. The stocks are distributed from southern Gabon to southern Angola. As the Project had access only to the northern part of the area of stocks distribution, no overall estimate of their potential could be achieved.

2.3.2 Demersal stocks

Senegal

Data on Spanish catches of deep-sea prawns (exploited on the continental slope in the Senegalese area) were supplied to the Working Party. No data on effort was available.

Table 15

Senegal: prawn fishery

1970 tons	1971 tons	1972 tons	1973* tons
6 114	5 668	6 751	5 107

*Preliminary data covering the period January-September only

Ivory Coast

Previous assessment reported to and discussed by the Working Party on Regulatory Measures for Demersal Stocks in its April 1972 Session[3/] estimated the potential of inshore demersal stocks on the Ivorian shelf at about 9 000 tons for a corresponding fishing effort of about 37 000 h of fishing (of a standard 400 hp trawler). Recent data on the Ivorian catch and effort in the Western Gulf of Guinea Division and for the last three years are summarized in the following table:

Table 16

Ivory Coast: Western Gulf of Guinea Division

	1970	1971	1972
Catch (tons)	9 016	5 388	5 179
Effort (h of fishing of standard trawler)	39 910	30 970	53 720
C.p.u.e. (tons/100 h)	22.6	17.4	9.6

In 1971, with the overexploitation of the stock, some fishing companies had to stop their activities. This resulted in a marked reduction of fishing effort which came below the level corresponding to the maximum potential; however, analysis of monthly data made available to the Working Party indicated that, after March 1972, the rate of fishing ex-

3/ See FAO Fish.Rep. No. 91

ceeded again that level reaching a monthly amount of 9 060 h in October 1972. Although part of this effort should have been exerted on other grounds (e.g. offshore stocks, inshore grounds off neighbouring countries), it is likely that the rate of fishing has again exceeded the level corresponding to the maximum production—a conclusion which is supported by the low catch rate in 1972. It also seems that no limitation of fishing has been applied to the Ivorian trawl fishery. In that context the Working Party discussed a report prepared by A. Fonteneau[4/] and approved its general conclusions: without implementation of proper limitation of fishing, as recommended in this report, the rate of exploitation of the stocks will eventually be limited by the zero profitability limit for this fishery, the results being a considerable loss.

As regards the stock of shrimp occurring on the continental shelf off Ivory Coast, the total catch reported by Ivory Coast for the Western Gulf of Guinea Division (1972) suggests that the present rate of exploitation is near the maximum potential (about 1 000 tons).

Ghana

Analysis of the length frequency distribution for sea breams caught off Ghana does not show significant changes in the size distribution of catches when comparing samples taken at the same periods of the year. It seems therefore that the rate of exploitation of these stocks has remained fairly constant.

Nigeria

Shrimp fishery

Table 17

Nigerian shrimp fishery: annual catches, efforts and c.p.u.e.

	1968	1969	1970	1971	1972
Effort: No. of days absence	1 928	2 515	3 455	5 269	5 222
Catch (head on) in metric tons	532	375	922	1 374	1 246
Catch/effort (kg/day)	276	148	267	261	239

As shown in Table 17 the fleet of commercial shrimpers has not increased during the last two years mostly because of the limited harbour facilities in Nigeria. The catch rates are still good but the oil pollution in the shrimp fishing area poses a possible danger if allowed to go on uncontrolled. Of the 27 shrimpers in operation, the one which fished most put in 278 fishing days (out of port) while the one which fished least stayed out for only 20 days. Another stayed out of port for only 57 days. Discounting these two particularly poor performances, the average for the remaining 25 was 206 days at sea. With better maintenance facilities and management, each boat should be able to put in 230 days

4/ A. Fonteneau. La pêche au chalut en Côte d'Ivoire: maximum de rendement économique. Document scientifique du Centre de Recherches Océanographiques d'Abidjan, II (1-2):31-39

at sea on the average, which would equate the total effort of the present fleet of 27 vessels to that of 23 well-run and maintained vessels.

Recruitment of a year-class into the fishery, how long it remains in the fishery before it is fished out, what times of the year these take place and the annual cycle of abundance were reported at the last meeting of the Working Party.

Since recruitment (into the sea fishery), which starts in January, is not completed until some time in July of the same year, only abundances of the age group from July-August until its disappearance from the catch just over a year later (14 months) could be compared for purposes of estimating mortality. Estimates of total mortality gave the following values:

Year-class	Total mortality coefficient
1970	2.4
1971	1.4
1972	2.5

Note: Each year-class starts recruiting into the fishery in January of that year, is fully recruited in July-August, and is fished for most of the next year. The variation in the Z values indicate that collection of data should be improved, both in quality and coverage (e.g. sampling shrimpers based in neighbouring countries and operating on the same grounds)

Fish trawl fishery

The landing statistics from commercial vessels are given in Table 18. Because of unrecorded activities of vessels from neighbouring countries or the fishing grounds facing the Nigerian shores, the total fishing effort on the stock cannot be ascertained. Catch rates for 1972 were very similar to those for 1971. Mesh regulations for fin-fish and for shrimp were in force late in 1972 and future analyses should show their effects.

Table 18

Nigeria: Total annual catch and effort statistics of the Lagos in-shore trawling fleet since 1960

Year	Total catch in tons	Effort in h	Catch per unit effort in kg/h	Number of boats
1960	3 481	38 184	91.2	17
1961	3 561	37 199.1	95.7	14
1962	3 263	31 195.62	104.6	20
1963	4 146	37 317.8	111.1	15
1964	2 172	27 530.2	78.9	15
1965	889	17 573.7	50.6	8
1966	865	17 893.91	48.3	12
1967	1 185	27 667.59	42.8	14
1968	698	19 111.55	36.5	8
1969	756	20 469.1	36.9	10
1970	842	23 920.5	35.2	12
1971	1 093	37 589.5	29.1	13
1972	1 403	47 019	29.8	26

Congo

An analysis of catch and catch per unit effort data for the Congolese trawl fishery (period 1960-1972) has been attempted. The general conclusions presented in the report of the last session remain valid (see paragraph 3.8). As mentioned in this report, large variations in the geographical distribution of fishing effort do not allow drawing definite conclusions on the potential of the inshore stocks in the area exploited by this fleet. In 1972 the average catch rate (4.4 tons/day fishing) was similar to the 1971 average (4.5) but the total effort and corresponding catches have slightly increased (from 4 000 tons and 886 fishing days to 5 460 tons and 1 240 fishing day respectively). Assessing the inshore stocks exploited by Congolese trawlers would require data on total catch and catch per effort data appropriately broken down by fishing grounds (e.g. Congo River mouth, Congolese shelf, Gabonese shelf); however, if operations of the Congolese trawlers remain largely limited to the stretch of shelf facing the Congolese shore, it is unlikely that the present production can be substantially increased. On the other hand, introduction of additional vessels should result in a substantial decrease in catch per unit of effort as already happened in 1970 when the trawlers present at that time were operating essentially on the Congolese shelf.

Results of selectivity studies for trawl, carried out on the Congolese shelf, were also presented. Selectivity coefficients have been determined for 10 species or groups of species selected for their importance in landings at Pointe-Noire. These results have been published in the following document:

Fontana, A. and P. M'Fina, 1974 Plan d'exploitation du stock de poissons démersaux au Congo, 1ère partie: Etude de la sélectivité des culs de chalut pour 4 maillages différents. Doc.Scient. Centre ORSTOM Pointe-Noire, No.34NS:12p

3 FUTURE WORK

3.1 Data collection and reporting

The meeting noted that a gradually increasing amount of basic data has become available to the Working Party but that many gaps still exist which prevent a proper analysis of the state of the stocks and of the fisheries. Improvements are required both in basic data collection in several countries and in reporting of the available information to the Working Party. It was agreed that each country should be requested to collect essential basic data, such as catch statistics and information on fishing effort and size composition of the catch, for each of its fisheries which are of some importance, but would concentrate its more detailed research efforts on selected stocks of major importance for the country. This would ensure that all essential data on all resources of major importance in the area would be collected. These data should be centrally reported and, after necessary collation, made available to all scientists for their studies. With proper international coordination of the detailed research programmes, all major stocks can be studied and the results reported through CECAF or otherwise.

It was noted that the Regional Fisheries Statistician for West Africa is assisting the countries in the area in the methods of data collection, compilation and reporting, and the meeting was also informed that two consultants of the new Project for the Development of Fisheries in the Eastern Central Atlantic will soon visit several non-African member countries of CECAF to assist in the compilation and reporting of the existing data required for the studies of the Working Party. It was agreed that, in addition to this assistance which was considered very important, the Secretariat should circulate a letter to each country, summarizing the data presently available to the Working Party and requesting the countries to inform the Secretariat which other data required for stock assessment could be provided. The meeting considered that this action would greatly contribute to and improve the data base for its work, and expressed the hope that the Secretariat would be able to provide the urgently needed increased support in the compilation and preparation of the information required by the Working Party.

In addition to these general considerations, the meeting discussed some specific items. Tagging was discussed as a method which could provide important information on several aspects of the resources, often at relatively low cost. In many cases, tagging programmes would require international cooperation, in which CECAF could help. There is also a need for training in the methodology and planning of tagging programmes and in the analysis of tagging data. With respect to octopus studies, some members mentioned the difficulties of measuring the animal due to the variation in its state of contraction. It was agreed that total length measurements were too variable, and that weight was best but difficult to obtain in practical conditions (at sea). It was recommended to make a comparative study of the accuracy obtained when using weight and mantle length.

The need and interest of exchange of data between the CECAF Working Party on Resources Evaluation and the ICES Southern Committees (both pelagic and demersal) were also stressed.

3.2 Needs for further fishery investigations

Considering the potential volume of the fisheries in the CECAF region—particularly in its northern part—and the present limitations in the quality and supply of information on stocks and fisheries, the Working Party reviewed and discussed actions which should be taken to improve the present situation.

In that respect reference was made to the CINECA programme and the Working Party expressed the wish that more emphasis be given to the fisheries aspects in this programme. In order to facilitate this orientation, the Technical Secretary of the Working Party was requested to prepare a short review of the fishery resources in the CINECA area; this review should be submitted as a background document to the participants at the forthcoming meeting of the Coordinating Group for the Planning and Execution of the CINECA Programme (Paris, 12-15 February 1974).

When discussing the problems faced in the evaluation of coastal pelagic stocks, it was noted that the Working Party, although it had at its disposal a rather substantial amount of catch per unit of effort data, found serious difficulties in interpreting the results of their analysis in terms of stock abundance and rate of exploitation. While recognizing the need for regularly collecting from each fishery basic data on catch, catch/effort, length frequency distribution, etc., and for refining the data on fishing effort so that better estimates of fishing mortality and stock abundance can be obtained, the Working Party stressed the great value of complementary methods, particularly quantitative surveys for assessing the stocks and monitoring their state of exploitation. In that respect, a distinction should be made between surveys aiming at providing absolute estimates of total standing stocks and surveys intended to monitor the relative changes in stock abundance. While the first require sophisticated equipment, the second can be carried out with simpler gear (qualitative acoustic sounders, trawls, etc.).

In this respect the Working Party noted that acoustic surveys are already one of the major elements of the CINECA programme. Although some of these surveys were carried out under this scheme and excellent findings obtained, not all the cruises originally planned were realized. It was also recognized that in areas where stocks are widely distributed and/or highly migratory, proper surveying requires the participation of several vessels, both for mapping and estimating the stocks in a sufficiently short time and for carrying out, through fishing, appropriate sampling of echo traces. Considering the great impact that such surveys could have on the evaluation of the resources in the northern part of the CECAF region, the Working Party made the following recommendation:

RECOMMENDATION

Acoustic Surveys and Fisheries Investigations in CINECA

The CECAF Working Party on Resources Evaluation,

recognizing that better knowledge of living resources of the CINECA area is of great importance and benefit to the development of fisheries in the area,

recognizing also the limitations of available catch per effort and effort data as indices of stock abundance and of fishing mortality and the usefulness of quantitative surveys for assessing and monitoring the state of the fish resources in that area, particularly the coastal pelagic stocks,

noting the urgency of this matter,

approaches the joint IOC/ICES/FAO (CECAF) Coordinating Group for the Planning and Execution of the CINECA Programme, to call upon the member states of CINECA to make every effort to include more work on quantitative echo surveys and biological data information on stocks in their national programmes of CINECA

During the discussions, it was also stressed that some facilities for carrying out acoustic surveys are already available in the region but direct assistance from FAO might be needed sometimes. In that respect mention was made of the CECAF Project and to the assistance it can give in that field to local institutions. The Working Party recommended that provision be made in the Project proposal so that laboratories in the region can obtain during their surveys the assistance of the FAO Acoustic Expert. The usefulness of cooperation between coastal countries in the planning and implementation of acoustic surveys, as well as in the interpretation of cruise results, was also stressed, and the Working Party recommended that the cooperation which already existed between countries in the CECAF region be strengthened.

The wish was also expressed that the research vessel under construction in Norway, to be based in the Indian Ocean, would carry out her trials in the CECAF region where she could usefully contribute to multiship acoustic surveys planned for this area.

3.3 Periodicity of the Working Party meetings

It was noted that the present limitations in the supply of data needed for assessing the stocks of the CECAF region were such that it would seem desirable to have a two-year period between successive meetings of the Working Party. In this connection it was indicated that the periodicity of meetings of the Working Party was adjusted to that of the Sessions of CECAF. In addition, the need—in terms of timing—for reviewing the state of stocks is determined more by changes occurring in stocks and their fisheries rather than by the speed at which data are made available. It was agreed that such matters should be referred for discussion to the forthcoming session of CECAF.

4 OTHER MATTERS

At its Third Session (Santa Cruz de Tenerife, 11-15 December 1973) CECAF requested the Working Party to collect information on fishery resources—other than tuna and conventional oceanic stocks—available outside the limits of national jurisdiction. Although the Working Party did not have at its disposal precise information on this matter, it noted that most of the resources available in the region with existing technology are located in waters above the continental shelf and the upper part of the slope. Acoustic surveys recently conducted in the northern part of the CECAF region identified dense concentrations of myctophids, particularly in canyons which are found along the continental slope.

* * * * * *

Appendix 1

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Appendix 2

AGENDA

1 Adoption of the agenda

2 Updating of assessments in the report of the last session

2.1 Review of catch and c.p.u.e. data

2.2 Other types of information:

surveys (acoustic, trawling)

biological data (length and age composition)

2.3 Inventory of fishery resources, other than tuna, available outside the limits of national jurisdiction

3 Evaluation of the effects on stocks and catches of possible regulatory measures

3.1 Limitation of fishing effort

3.2 Selectivity: further studies, as recommended by the Sub-committee on Implementation of Management Measures, on regulation of mesh size in the sparid and cephalopod fisheries (including the question of by-catches)

4 Future work

4.1 Inventory and updating of data requirements (kinds, forms, measurement of cephalopods, etc.)

4.2 Compilation of data: present situation

4.3 Action needed for improving this situation

5 Other matters

6 Adoption of the report

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Appendix 3

SUMMARY OF CATCH STATISTICS FOR THE CECAF AREA

Table 1

Estimated total catches of European and Senegalese/Mauritanian hakes by countries

Thousands metric tons

Species	Country	1965	1966	1967	1968	1969	1970	1971	1972
European hake (a)	Greece	-	-	3.4	7.5	-	-	-	-
	Japan	0.0	...	0.0	0.1	0.0	0.3	0.0	0.5
	Morocco	2.6	3.9	4.0	3.4	2.5	4.9	2.5	2.6
	Total	2.6	3.9	7.4	10.9	2.5	5.2	2.5	3.1
Senegalese/Mauritania hakes (a)	Bulgaria	-	-	-	0.0	0.0	0.0	-	0.1
	Cuba	-	-	-	-	0.3	1.2	0.3	-
	Ghana	-	-	-	-	-	-	-	0.2
	Israel	0.5	0.1	-	-	-	-	-	-
	Poland	-	-	1.0	0.2	1.1	0.1	0.1	0.3
	Portugal	9.5	10.4	10.3	11.1	9.9	6.7	5.1	F5.1
	Romania	-	-	-	-	0.0	-	0.0	0.1
	Spain	F14.0	F14.0	F14.0	F14.0	F13.0	F12.0	F10.5	10.1
	U.S.S.R.	0.8	2.1	6.7	2.5	3.4	3.0	4.8	18.1
		24.8	26.6	32.0	27.8	27.7	23.0	20.8	34.0
	TOTAL HAKES	27.4	30.5	39.4	38.7	37.7	31.7	23.3	37.0

(a) Breaking down of hake catches by species has been based on location of catches: European hake is predominant in Division 34.1.1 (Morocco Coastal) while Senegalese/Mauritanian mainly caught in Divisions 34.1.3 (Sahara Coastal) and 34.3.1 (Cape Verde Coastal)

F Official Spanish statistics as reported to FAO are obviously too low for years prior to 1972, due to inadequate reporting by major fishing areas. Estimated values presented in this table were extrapolated on the basis of general trends in the fishery

Table 2

Northern subtropical area: Annual catches of sparids (all species combined) by countries

	1965	1966	1967	1968	1969	1970	1971	1972
Bulgaria				0.1	0.1	0.5	0.2	0.7
Greece	11.0	11.6	13.3	12.6	6.7	13.2	13.2	13.2
Ghana*	3.5	1.2	5.1	2.8	8.0	11.3	6.5	9.2
Germany, D.R.						0.2	1.1	1.1
Israel				0.1	0.4			
Japan	14.3	16.0	24.0	24.4	26.5	14.0	9.3	15.9
Korea								1.6
Morocco	1.8	2.0	2.0					2.8
Poland	3.1	2.6	2.2	1.5	0.7	0.3	2.6	2.5
Portugal	7.8	6.0	5.9	4.9	5.2	5.2	3.0	3.0
Romania	0.1	0.1				0.1	1.0	1.9
Senegal	12.9	12.3	8.9	7.8	10.3	17.2	26.6	20.2
Spain	27.7	26.4	19.8	18.0	18.4	14.4	14.4	4.7
U.S.S.R.	18.2	16.2	22.7	30.9	41.1	51.2	74.3	80.7
	100.4	94.4	103.9	103.1	117.4	127.6	152.2	157.5

* Includes unknown Ghanaian catches outside the northern subtropical area

Table 3

CECAF area: Annual catches of sparids by main species (estimates)

Boops boops	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Dentex dentex	2.0	2.9	1.4	1.6	1.4	1.3	1.3	-
Deuter macrophthalmus	4.4	4.4	2.9	2.5	2.9	2.2	2.4	0.7
Deuter n.e.i.	11.2	11.2	11.4	10.3	13.5	27.6	41.8	35.9
Pagellus acarne	0.0	0.3	0.8	1.4	0.7	0.4	0.7	1.1
Pagellus bellotti	8.9	10.4	14.0	9.7	13.2	7.8	6.0	9.6
Pagellus centrodontus	3.0	2.7	1.6	1.4	1.7	1.6	1.6	2.5
Pagellus erythrinus	19.9	17.8	15.9	15.9	12.5	13.1	13.1	10.3
Pagrus pagrus	4.4	3.8	2.3	2.1	1.9	1.6	1.6	-
Sparus auratus	1.1	0.8	0.7	0.6	0.6	0.6	2.2	1.8
Sparids n.e.i.	45.7	42.6	53.0	69.8	75.8	78.5	83.7	99.4
	100.9	94.9	104.4	115.5	124.1	134.4	154.6	161.3

Table 4

Northern subtropical area: Annual catches of cephalopods by countries

	1965	1966	1967	1968	1969	1970	1971	1972
Cuttlefish								
Greece	...	...	...	...	...	...	...	...
Italy	...	...	...	...	...	...	...	...
Japan	29.0	27.0	32.5	26.7	25.4	13.7	15.9	18.0
Morocco	1.0	1.2	0.9	1.1	1.1	1.0	1.2	0.5
Portugal	1.9	1.2	1.7	1.3	1.0	1.0	...	...
Spain	8.2	7.7	7.8	7.7	F6.5	F4.9	F4.9	12.0
Total	40.1	37.1	42.9	36.8	33.9	20.8	21.8	30.5
Squid								
Argentina	-	-	-	-	-	0.1	0.0	0.0
Cuba	-	-	-	0.0	0.0	0.0	0.0	-
Greece	...	...	...	...	...	...	...	...
Italy	...	...	...	...	...	...	...	...
Japan	9.6	6.0	7.9	6.0	7.8	5.0	5.1	4.3
Korea, Rep.	...	...	...	...	...	...	...	3.6
Portugal	0.3	0.3	0.3	0.3	0.2	0.1	...	...
Spain	3.5	4.7	6.1	5.4	F6.5	F7.4	F7.4	12.9
U.S.S.R.	-	-	-	-	1.6	1.4	2.8	5.1
	13.4	11.0	14.3	11.7	16.1	14.0	15.3	25.9
Octopus								
Argentina	-	0.7	0.9	0.4	-	0.4	0.6	0.5
Cuba	-	-	-	0.0	-	-	-	-
Japan	33.4	22.6	54.8	65.0	52.2	50.9	38.1	25.3
Greece	...	...	...	...	...	...	...	...
Italy	...	...	...	...	...	...	...	...
Korea, Rep.	...	...	...	...	...	...	...	1.6
Spain	35.9	39.1	41.6	41.7	F29.3	F20.0	F20.0	87.3
	69.3	62.4	97.3	107.1	81.5	71.3	58.7	114.7
TOTAL CEPHALOPODS	122.8	110.5	154.5	155.6	131.5	106.1	95.8	171.1

F - estimated by the Working Party
... data not available
- nil or negligible

Table 5

Northern subtropical area: Annual catch by species (in 1000 tons) of the pelagic species (excluding European sardine) by trawl and purse seine (estimates)

a) ALL GEARS

Species	1965	1966	1967	1968	1969	1970	1971	1972
Sardinella	45.8	38.8	56.7	63.7	217.3	657.1	471.3	504.0
Horse mackerel	51.7	37.1	101.9	166.0	257.8	297.1	480.0	453.1
Mackerels	55.9	36.0	67.3	62.2	186.1	224.0	212.6	234.7
TOTAL	153.4	111.9	225.9	291.9	661.2	1178.2	1163.9	1191.8

b) TRAWLS

Species	1965	1966	1967	1968	1969	1970	1971	1972
Sardinella	1.1	8.1	7.2	27.0	59.0	26.0	23.2	28.9
Horse mackerel	49.8	35.6	97.9	162.8	209.6	177.8	193.0	225.4
Mackerels	55.9	36.0	67.3	62.2	161.9	167.3	132.6	147.6
TOTAL	106.8	79.7	172.4	252.0	430.5	371.1	348.8	401.9

c) PURSE SEINES

Species	1965	1966	1967	1968	1969	1970	1971	1972
Sardinella	44.7	30.7	49.5	36.7	158.3	631.1	448.1	475.1
Horse mackerel	1.9	1.5	4.0	3.2	48.2	119.3	287.1	227.7
Mackerels	-	-	-	-	27.2	56.7	80.0	87.1
TOTAL	46.6	32.2	53.5	39.9	230.7	807.1	815.2	789.9

Table 6

European sardine (Clupea pilchardus)
Annual catches by countries

COUNTRY	1965	1966	1967	1968	1969	1970	1971	1972	1973
Mauritania	-	-	-	-	-	-	-	(10)	(20)
Bulgaria	-	-	-	-	-	-	-	1.2	
France	5.5	4.4	11.6	8.3	10.4	11.6	11.3	4.6	
Morocco	154.6	244.8	203.5	162.5	162.4	156.9	172.6	171.5	(320)
Poland	-	-	-	-	-	-	-	1.4	(10)
Romania	-	0.0	0.0	1.5	-	-	-	-	
Spain	12.1	21.2	19.0	22.1	27.2	27.3	(27.3)	35.9	
U.S.S.R.	-	-	-	-	-	(20)	(30)	(40)	(50)
TOTAL	172.2	270.4	234.1	194.4	200.0	215.8	241.2	264.6	

( ) = estimated

* * * * * *

Appendix 4

JAPANESE RESEARCH REPORT FOR 1972

by

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Japanese trawlers have operated mainly in the Sahara and Cape Verde Coastal Divisions but sporadic operations took place in the north of the Sahara Division and in the Gulf of Guinea during 1972. The total catch in 1972 increased slightly to 99 600 tons from 88 000 tons in 1971. It should be noted, however, that the statistical basis is somewhat different between those two years. The figure in 1972 includes the catch by the joint venture but that in 1971 does not.

The catches of grunts, sparids and cuttlefishes increased and those of squids and octopuses decreased.

Studies, especially stock assessment based on catch and biological data, on main stocks in the CECAF area have been continued. Although the Cape Verde Coastal Division is classified in the southern coastal subarea, this division is treated as the northern coastal subarea in this report because almost all the fishing grounds covered by Japanese trawlers in the division are northward of 16°N latitude.

Table 1

Brief catch statistics of Japanese trawlers including catch from the joint venture with Mauritania in 1972

Species	Area total	Sahara Coastal Division	Cape Verde Coastal Division
Total (10^3 tons)	99.6 (88.0)	80.4 (73.2)	19.1 (14.7)
Flounders	1.5 (1.7)	1.3 (1.4)	0.2 (0.3)
Grunts	2.7 (1.6)	2.4 (1.3)	0.4 (0.3)
Porgy	2.0 (0.8)	0.6 (0.3)	1.3 (0.5)
Pagellus bellotti	10.1 (6.0)	7.9 (5.3)	2.1 (0.7)
Other sparids	4.7 (2.6)	3.9 (2.1)	0.8 (0.4)
Horse mackerel	5.3 (5.0)	3.7 (3.6)	1.6 (1.4)
Common cuttlefishes	21.4 (15.9)	14.6 (9.8)	6.8 (6.1)
Squids	4.6 (5.1)	4.2 (5.0)	0.5 (0.1)
Octopuses	33.0 (38.1)	31.0 (36.1)	2.0 (1.9)

Figures in brackets are for 1971 when the statistics do not include the catch of the joint venture

NORTHERN COASTAL SUBAREA (INCLUDING CAPE VERDE COASTAL DIVISION)

Status of the fisheries

Trends of fishing effort by vessel sizes in several years are shown in Table 2. Decrease of effort is observed clearly in the trend of large trawlers over 1 000 GT but the effort by small trawlers and the total effort increased in 1972 because of inclusion of data from the joint venture.

Table 2

Effort in 1 000 h hauled by sizes of trawler

Year	-550	-999	-1 999	over 2 000	Total
1967*	50.3	33.4	100.7	35.8	235.8
1968	67.5	39.6	110.5	56.7	274.3
1969	64.7	40.9	114.9	44.6	265.1
1970	62.3	41.7	119.7	31.2	254.9
1971	63.4	51.7	110.4	15.9	241.4
1972**	89.2	44.8	84.3	23.6	290.9

* Somewhat over-estimated

**Including the joint venture effort

Special research studies

Pagellus bellotti

In the previous report, stock assessment was made on the basis of the abundance index calculated from the record of 2 500-3 000 GT trawlers. As indicated in the table above, the activity of Japanese trawlers in this size category has decreased in recent years. A recalculation derived from the records of 1 500-2 000 GT trawlers was made from the 1969-70 fishing year to the first half of the 1972-73 fishing year. Results are shown in Table 3.

Table 3

Catch, abundance index and age composition of P. bellotti in Sahara Coastal Division (Abundance index was calculated by the record of 1 500-2 000 GT trawlers)

Period	Catch in 10t	Abun.* Index* (W)	(N)	Age composition 1	2	3	4	5	6	7	8	9	10
1969-70	10.7	47	294	1.5	24.1	74.7	97.3	57.0	23.5	8.8	3.8	2.1	0.9
1970-71	6.6	56	313	5.6	11.9	27.9	135.2	79.2	32.9	12.2	4.7	2.2	1.6
1971-72	6.2	70	443	23.0	45.6	98.3	137.8	62.9	40.8	20.4	8.4	4.0	2.2
1972-73**	4.5	71	483	21.7	61.3	125.6	149.7	60.4	32.8	28.8	6.8	2.9	1.9

* (W) = kg per hour, block and month
(N) = number per hour, block and month

** Incomplete

The total mortality coefficient calculated from age 4 to age 7 in 1972 was observed as 0.77. Assuming the natural mortality as 0.2, fishing mortality is estimated to be around 0.6. It seems that the optimum level of fishing effort is achieved in the term of yield per recruit as was mentioned previously; however, the number of small fish caught under age 3 is gradually increasing to 43% in the 1971-72 fishing year. Since the regulations of mesh size for spariformes have been introduced in 1972, the effect on this species will be observed sometime later.

Sepia spp

Observations on the geographical distribution of subspecies of Sepia were made aboard the Japanese trawlers in 1971 and 1972. A detailed report will be available later. Briefly, it was observed that Sepia officinalis officinalis and Sepia officinalis hierredda are most commonly found in both Sahara divisions and the northern part of the Cape Verde Coastal Division. S. officinalis officinalis is abundant north of Cape Blanc, S. officinalis hierredda is common on the inshore side south of Cape Blanc, and S. officinalis officinalis is also caught on the offshore side of the grounds. Stocks of other Sepia species sampled are rather unimportant.

The catch for each division and the abundance index derived from data from 1 000-1 500 GT trawlers, together with average effective effort, are shown in Table 4. The fishing period is taken from April to the following March.

Table 4

Catch and abundance index of Sepia spp

Period	Catch in 1 000 tons			Abundance index in kg/h,b,m										Standardized effective effort		
				Sahara Coastal					Cape Verde Coastal							
	Total	Sahara	Verde	Sum*	L	M	S	J	Sum*	L	M	S	J	Sum	Sahara	Verde
1966-67	23.1	19.3	1.0	167	104	30	16	7						12.2		
1967-68	34.8	32.3	0.6	162	84	32	22	8						18.1		
1968-69	26.2	24.0	1.9	110	55	18	17	4						20.2		
1969-70**	21.3	18.4	2.9	82	31	13	16	5	116	28	11	3	0	21.8	18.6	3.2
1970-71	12.7	9.7	3.0	55	27	11	10	5	80	33	24	14	6	19.1	14.8	4.3
1971-72	16.7	10.0	6.7	56	26	10	15	4	110	43	44	17	3	20.2	14.0	6.2
1972- ***	17.6	12.1	5.5	70	24	15	19	8	147	41	24	9	4	22.9	18.5	4.4

* Due to unclassified landings, the overall figure is different from the sum of the ones by size categories

** Breakdown between Divisions is modified in January 1970

***Incomplete data

Effort is given in 1 000 h fished per month. Abbreviations L, M, S and J indicate "Large", "Medium", "Small", and "Juvenile", respectively

The fishing effort for the species was dispersing to the southern division since the 1969-70 fishing period. The abundance indices in both divisions have slightly increased in the 1972-73 season. The number of large fish caught in the northern division is gradually decreasing. It is evident in the table that recruitment does not appear to decrease and that a predominant year-class was not observed in recent years.

Octopus vulgaris

It was noted that the geographical distribution of the fishing effort directed to this species changed markedly from previous years because of the extension of the territorial waters near the fishing grounds off Cape Blanc. It was observed that fluctuations occurred in the abundance biennially; because the geographical distribution of effort has changed since 1972, the abundance index and standardized fishing effort for the last fishing year (Table 5) are therefore not comparable with the data available before the 1971-72 period.

Table 5

Catch and abundance index of O. vulgaris in the Sahara Coastal Division (The fishing year is taken as July to June)

Fishing year	Catch in 1 000 t	Abundance index kg/h, b, and m	Standardized fishing effort in 1 000 h/month
1964-65	20.6	161	7.9
1965-66	18.9	119	12.0
1966-67	37.6	160	16.8
1967-68	49.3	130	30.9
1968-69	72.8	189	32.9
1969-70	31.2	89	27.6
1970-71	39.6	101	32.9
1971-72	36.8	81	37.5
1972-*	15.8	59	42.4

* Incomplete

Loligo spp

Statistics of catch and abundance of squids are shown in Table 6. Squids are mostly composed of Loligo vulgaris but the species breakdown is not available yet. Roughly speaking, the annual catch in recent years has been fluctuating between 4 000 tons and 6 000 tons. It seems that two levels of stock abundance have been observed in the series of abundance index.

This may indicate some biennial fluctuation in squid abundance, as was observed in the octopus stock; however, the occurrence of good and bad years is reversed in these two species. If it is the case, together with the short life span of this species, it can be assumed that recruitment of the stock in recent years is steady within the range of oscillation.

Table 6

Catch and abundance index of Loligo spp in the Sahara Coastal Division

Year	Catch in tons	Abundance index* kg/h, b and m	Standardized fishing effort in 1 000 h**
1964	2 677	86	34.9
1965	5 710	68	78.0
1966	3 827	38	107.8
1967	11 400	52	229.4
1968	6 515	33	207.4
1969	5 540	26	203.1
1970	4 242	30	141.3
1971	4 973	54	105.8
1972	4 177	30	134.5

* Figures are estimated by records of trawlers classified as 1 000–1 500 GT

** Efforts are standardized to those of 1 000–1 500 GT trawler

* * * * * *

Appendix 5

NOTE ON LENGTH DATA (1971 AND 1972)

by

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All individuals of certain species caught have been classified into size categories such as "large", "medium", as is usually done on board Japanese trawlers. The length classification of the size category does not change between different seasons, locations and vessels.

The length composition of each size category is therefore measured on board trawlers. The length composition by size categories, namely key table, for Pagellus bellotti and Sepia spp in 1971-1972 are shown in the appended tables.

On the other hand, catch statistics for both species have also been summed up by the same categories. The length composition of each species fished is estimated from the key table mentioned above and the catch record by size categories.

Length measurements are made of the fork length for P. bellotti and the mantle length for Sepia spp to the nearest centimetre. These are reported by 1-cm group.

Table 1

Length composition for each size category, Pagellus bellotti in 1971-1972

Fork length	Body weight	Size Category								
		101113	101417	111113	111417	121113	121417	131113	131417	140000
5	4	-	-	-	-	-	-	-	-	5
6	7	-	-	-	-	-	-	-	-	7
7	10	-	-	-	-	-	-	-	-	24
8	14	-	-	-	-	-	-	-	-	31
9	20	-	-	-	-	-	-	-	-	73
10	26	-	-	-	-	-	-	1	-	96
11	34	-	-	-	-	-	-	12	-	51
12	44	-	-	-	-	-	-	55	-	31
13	55	-	-	-	-	-	1	155	-	38
14	67	-	-	-	-	-	3	263	-	46
15	82	-	-	1	-	8	9	274	-	62
16	98	-	-	4	-	99	26	166	14	82
17	116	-	-	18	-	369	60	61	178	77
18	137	-	-	56	-	395	104	13	482	91
19	159	2	-	127	1	119	156	2	288	70
20	184	7	-	203	3	10	182	-	37	37
21	212	22	-	235	19	-	176	-	1	46
22	241	54	-	187	64	-	132	-	-	37
23	274	104	-	108	143	-	85	-	-	52
24	310	156	2	45	226	-	43	-	-	28
25	347	191	5	13	242	-	16	-	-	9
26	387	183	16	3	177	-	6	-	-	4
27	435	139	43	-	87	-	1	-	-	-
28	480	85	88	-	30	-	-	-	-	1
29	532	39	141	-	7	-	-	-	-	-
30	587	14	181	-	1	-	-	-	-	-
31	642	5	190	-	-	-	-	-	-	-
32	704	1	153	-	-	-	-	-	-	-
33	768	-	99	-	-	-	-	-	-	-
34	839	-	51	-	-	-	-	-	-	-
35	912	-	22	-	-	-	-	-	-	-
36	988	-	7	-	-	-	-	-	-	-
37	1,067	-	2	-	-	-	-	-	-	-
38	1,153	-	-	-	-	-	-	-	-	-
39	1,243	-	-	-	-	-	-	-	-	-
Total		1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Number of samples		9	4	14	5	14	5	13	9	11
Number of fish		277	120	426	124	429	165	479	334	1,048
Mean length in cm		25.81	31.12	21.38	25.17	18.05	20.78	15.05	18.66	
Standard deviation		2.047	2.070	1.687	1.591	0.844	2.147	1.359	0.755	
Mean weight in g		366	628	212	338	128	197	77	141	113

$W_{(g)} = 3.45\ L_{(mm)}^{2.91}\ 10^{-5}$.

Table 2

Length composition for each size category, Sepia spp in 1971-1972

Mantle length	Body weight	Size Category 7000	7100	7200	7300	7400
less than 5		-	-	-	30	1
5	25	-	-	-	37	4
6	39	-	-	-	64	21
7	58	-	-	2	99	30
8	81	-	-	4	129	39
9	111	-	-	11	153	33
10	146	-	-	28	147	63
11	187	1	1	59	126	66
12	235	2	2	94	94	91
13	291	2	7	137	60	105
14	354	3	19	159	35	78
15	425	5	40	163	16	74
16	506	8	76	135	7	67
17	594	11	116	97	2	58
18	693	16	152	60	1	57
19	798	23	166	29	-	51
20	919	29	153	13	-	40
21	1,048	38	119	5	-	26
22	1,185	46	78	2	-	27
23	1,338	55	42	-	-	23
24	1,499	63	19	-	-	17
25	1,672	69	7	-	-	9
26	1,858	75	2	-	-	5
27	2,059	76	1	-	-	4
28	2,269	72	-	-	-	1
29	2,495	71	-	-	-	1
30	2,736	66	-	-	-	2
31	2,990	59	-	-	-	3
32	3,260	51	-	-	-	1
33	3,542	42	-	-	-	1
34	3,841	34	-	-	-	2
35	4,155	26	-	-	-	-
36	4,481	19	-	-	-	-
37	4,824	14	-	-	-	-
38	5,195	9	-	-	-	-
39	5,569	7	-	-	-	-
40	5,968	4	-	-	-	-
41	6.375	3	-	-	-	-
42	6,815	1	-	-	-	-
43	7,258	-	-	-	-	-
Total		1,000	1,000	1,000	1,000	1,000
Number of samples		50	51	46	31	20
Number of fish		1,645	1,690	1,512	1,087	1,423
Mean mantle length		27.76	19.52	15.02	9.93	
Standard deviation		5.278	2,374	2.414	2.619	
Mean weight (g)		2,293	809	415	144	509

$W_{(g)} = 4.03\ L_{(mm)}^{2.75}\ 10^{-4}$.

LENGTH FREQUENCIES
(‰)

No .....

SPECIES Sepia spp.

COUNTRY JAPAN YEAR 1978 ACCREDIT REPORT TO .....

DIVISION C.Verde Coastal GEAR OTTER TRAWL CATCHES/LANDINGS CATCH

RESEARCH OR COMMERCIAL FISHING COMMERCIAL FISHING REMARKS Mantle length

Length group (cm) \ Months	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
0													
1													
2													
3													
4	1	1	3	1	4	6	8	15	8	6	5	3	6
5	3	4	6	3	5	8	10	19	11	8	6	4	8
6	15	20	18	11	9	17	21	33	25	19	12	8	18
7	21	28	27	16	15	26	32	52	38	29	19	12	27
8	27	37	35	22	19	34	42	68	49	39	26	16	33
9	33	31	34	21	24	39	48	82	54	42	31	20	39
10	45	59	54	37	31	47	55	85	68	55	40	25	51
11	49	62	58	45	39	51	57	85	69	53	43	32	54
12	68	86	74	59	50	57	60	78	77	69	59	40	64
13	79	100	85	75	62	64	64	74	82	77	71	49	72
14	82	75	69	67	69	65	60	67	70	68	75	55	66
15	82	72	68	71	75	67	61	62	67	68	77	58	67
16	79	66	65	72	77	69	62	55	62	66	75	59	66
17	74	60	57	72	78	71	63	49	56	63	70	59	64
18	56	59	57	75	79	75	65	45	55	63	67	60	65
19	55	54	52	72	74	71	62	38	49	58	60	58	61
20	45	45	43	61	64	62	54	31	40	49	51	52	52
21	34	29	31	46	50	47	43	23	29	36	39	44	39
22	33	29	29	37	36	34	31	15	24	29	30	37	31
23	30	24	24	27	24	22	20	9	17	21	21	31	22
24	25	18	19	19	17	14	14	5	13	15	16	22	16
25	20	10	10	14	12	9	10	3	7	10	13	27	11
26	18	7	11	11	11	7	8	2	5	8	12	27	9
27	18	6	11	11	11	6	8	1	5	7	12	27	9
28	15	3	8	9	10	5	6	1	3	6	10	26	7
29	15	3	8	9	10	5	6	1	3	5	10	25	7
30	14	3	8	8	9	5	6	1	3	5	10	24	7
31	14	4	8	8	8	5	6	1	3	5	9	21	7
32	11	2	6	6	7	4	5	1	2	4	7	18	5
33	9	2	5	5	6	3	4	1	2	3	6	15	4
34	8	3	5	5	5	3	3	1	2	3	5	12	4
35	5	1	3	3	4	2	2	-	1	2	4	9	3
36	4	-	2	2		1	2	-	1	1	3	7	2
37	3	0	2	2	2	1	1	-	1	1	2	5	1
38	2	-	1	1	1	1	1	-	-	1	1	3	1
39	1	-	1	1	1	-	1	-	-	-	1	2	1
40	1	-	-	-	1	-	-	-	-	-	1	1	0
41	1	-	-	-	-	-	-	-	-	-	-	1	0
42													
43													
44													
45													
Total ‰	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Number of samples													
Number of fish measured													
Mean length (cm)	17.45	15.15	16.00	17.04	17.24	15.89	15.57	12.88	14.41	15.16	16.70	19.61	15.96
Mean weight (g)	874	560	690	766	790	644	638	376	511	645	755	1,157	675
Range of depths (m)													
Mesh size (mm)													

LENGTH FREQUENCIES
(‰)

No .....

SPECIES Pagellus bellottii

COUNTRY JAPAN YEAR 1971 ACCREDIT REPORT TO .....

DIVISION Sahara Coastal GEAR OTTER TRAWL CATCHES/LANDINGS CATCH

RESEARCH OR COMMERCIAL FISHING COMMERCIAL FISHING REMARKS Fork length

Length group (cm) \ Months	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
5	1	-	-	1	1	-	2	2	1	1	1	1	1
6	2	-	-	1	1	1	3	3	2	1	1	1	1
7	6	1	-	3	5	2	9	11	6	3	2	4	5
8	8	1	-	4	6	3	12	14	8	4	3	2	6
9	20	2	-	10	15	6	28	32	19	10	7	13	14
10	36	3	1	13	19	8	36	42	26	13	10	17	18
11	17	6	6	8	10	5	20	22	15	8	7	9	12
12	22	21	28	9	7	4	13	14	14	10	9	7	15
13	51	59	80	18	10	8	18	17	26	23	22	10	33
14	82	99	136	29	14	13	24	20	32	36	33	14	53
15	91	107	145	36	19	16	32	29	46	42	41	21	60
16	94	110	119	71	36	24	48	50	57	54	65	57	70
17	155	208	157	196	106	79	81	91	100	115	139	181	135
18	191	235	154	236	196	182	114	122	130	155	183	254	175
19	94	91	63	114	157	143	90	97	97	109	96	142	102
20	32	20	28	63	76	79	74	85	87	91	70	92	72
21	30	13	27	65	75	71	82	98	97	92	77	65	65
22	35	11	22	51	65	65	71	81	80	81	65	51	54
23	24	7	14	36	57	63	67	66	60	57	48	37	43
24	13	3	8	18	47	62	52	40	36	34	32	19	27
25	6	1	4	8	36	54	40	23	21	21	24	8	18
26	4	-	3	4	24	38	30	16	14	14	19	4	12
27	2	-	2	2	12	20	17	10	8	8	13	2	7
28	1	-	1	1	6	11	10	6	5	5	8	1	4
29	1	-	1	1	4	9	7	3	2	2	4	1	3
30	-	-	-	1	4	10	6	2	1	1	1	1	2
31	-	-	-	1	4	10	5	2	1	1	1	1	1
32	-	-	-	-	3	8	4	1	1	1	-	1	1
33	-	-	-	-	2	5	3	1	-	-	-	-	1
34	-	-	-	-	1	3	1	-	-	-	-	-	0
35	-	-	-	-	1	1	-	-	-	-	-	-	0
36													
37													
38													
39													
40													
Total ‰	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Number of samples													
Number of fish measured													
Mean length (cm)	16.64	16.60	16.50	18.03	19.31	20.52	19.04	18.39	18.46	18.83	18.76	18.21	18.03
Mean weight (g)	122	114	115	148	187	221	190	169	166	171	169	152	154
Range of depths (m)													
Mesh size (mm)													

LENGTH FREQUENCIES
(‰)

No.....

SPECIES Pagellus bellottii

COUNTRY JAPAN YEAR 1971 ACCREDIT REPORT TO .....

DIVISION C. Verde Coast GEAR OTTER TRAWL CATCHES/LANDINGS CATCH

RESEARCH OR COMMERCIAL FISHING COMMERCIAL FISHING REMARKS Fork length

Length group (cm) \ Months	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
5	2		-		-	3	3	-	3	1	3	3	2
6	3		-		1	4	4	-	5	1	4	4	2
7	12		-		2	12	12	1	16	5	14	14	8
8	15		-		3	16	16	1	21	7	18	18	10
9	35		-		7	37	37	2	49	15	45	43	23
10	47		-		10	49	49	3	65	20	57	57	30
11	25		-		7	28	29	6	35	11	30	34	18
12	15		-		13	24	30	22	21	7	18	36	20
13	18		-		34	43	62	63	26	8	22	74	43
14	22		-		56	63	96	106	31	10	27	115	66
15	31		1		64	74	109	115	42	15	37	128	76
16	42		4		85	78	101	116	60	30	56	103	85
17	47		18		186	106	111	204	110	107	108	80	145
18	73		56		203	151	120	201	218	251	206	96	180
19	99		127		95	98	67	72	141	181	137	64	97
20	122		205		61	48	30	25	37	79	48	25	47
21	143		235		65	61	35	24	31	67	44	27	48
22	114		187		52	40	27	19	25	55	35	22	39
23	81		108		33	40	32	12	35	48	41	31	33
24	37		45		15	21	18	5	19	35	24	16	17
25	11		13		5	7	7	2	6	23	11	5	6
26	3		3		2	4	3	-	3	15	6	2	3
27	-		-		-	1	1	-	-	6	2	-	1
28	-		-		-	1	1	-	1	2	2	1	1
29	-		-		-	-	-	-	-	-	1	-	0
30	-		-		-	1	-	-	-	-	1	-	0
31	-		-		-	1	-	-	-	-	1	-	0
32	-		-		-	-	-	-	-	-	1	-	0
33	-		-		-	-	-	-	-	-	1	-	0
34													
35													
36													
37													
38													
39													
40													
Total %	1,000		1,000		1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Number of samples													
Number of fish measured													
Mean length (cm)	18.25		20.88		17.65	16.57	15.88	16.16	16.34	18.71	16.95	15.37	16.91
Mean weight (g)	164		212		139	126	111	115	122	166	135	103	128
Range of depths (m)													
Mesh size (mm)													

LENGTH FREQUENCIES
(‰)

No.....

SPECIES Pagellus bellottii

COUNTRY JAPAN YEAR 1972 ACCREDIT REPORT TO .....

DIVISION Sahara Coastal GEAR OTTER TRAWL CATCHES/LANDINGS CATCH

RESEARCH OR COMMERCIAL FISHING COMMERCIAL FISHING REMARKS Fork length

Length group (cm) \ Months	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
5	2	1	1	1	1	1	2	3	2	1	1	2	2
6	2	1	1	1	2	2	2	4	3	1	1	3	2
7	7	3	5	5	6	7	8	13	11	3	3	11	8
8	9	5	6	6	8	9	10	16	14	4	4	14	10
9	22	11	14	15	19	20	24	38	32	10	9	34	24
10	29	14	19	20	25	27	32	50	42	13	12	44	31
11	16	10	13	14	15	15	20	28	24	8	7	25	18
12	10	14	19	23	17	12	22	22	21	9	7	21	17
13	15	34	44	57	36	21	47	37	37	18	12	37	34
14	19	56	71	92	56	30	74	54	55	29	18	55	51
15	27	64	79	101	64	37	84	64	64	33	22	65	59
16	54	85	79	93	75	57	93	73	69	41	40	74	70
17	130	187	139	128	128	154	131	105	99	129	144	107	127
18	177	210	197	136	144	267	188	151	140	265	274	139	181
19	115	95	112	74	87	154	107	97	96	165	166	94	109
20	83	48	48	50	69	49	39	48	58	57	61	62	56
21	89	50	45	55	77	40	36	51	64	48	54	68	57
22	73	41	37	45	63	32	29	42	53	41	45	54	47
23	56	31	30	35	48	29	28	44	48	34	35	47	40
24	32	18	18	20	26	17	16	26	28	24	23	24	23
25	17	10	10	11	14	9	7	13	15	19	16	9	12
26	10	6	6	7	9	5	4	9	10	16	13	5	8
27	4	3	3	4	5	2	2	4	6	11	9	2	4
28	2	2	2	3	3	2	1	3	4	8	6	1	3
29	-	1	1	1	1	1	1	1	2	5	4	1	1
30	-	1	-	-	-	1	1	1	1	3	3	1	1
31	-	1	-	-	-	-	1	1	1	3	3	-	1
32	-	-	-	-	-	-	1	-	1	2	2	-	1
33	-	-	-	-	-	-	-	-	1	1	2	-	0
34	-	-	-	-	-	-	-	-	-	1	1	-	0
35													
36													
37													
38													
39													
40													
Total ‰	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Number of samples													
Number of fish measured													
Mean length (cm)	18.28	17.55	17.29	17.08	17.74	17.55	16.73	16.86	17.32	18.62	18.72	17.05	17.44
Mean weight (g)	159	139	135	132	148	140	126	134	144	166	168	136	142
Range of depths (m)													
Mesh size (mm)													

LENGTH FREQUENCIES
(‰)

No .....

SPECIES Pagellus bellottii

COUNTRY JAPAN YEAR 1972 ACCREDIT REPORT TO .....

DIVISION C. Verde Costal GEAR OTTER TRAWL CATCHES/LANDINGS CATCH

RESEARCH OR COMMERCIAL FISHING COMMERCIAL FISHING REMARKS Fork length

Length group (cm) \ Months	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
5	2	5	3	-	1	1	2	3	1	1	-	-	1
6	2	7	5	-	1	2	3	4	2	1	-	-	1
7	8	24	16	1	4	7	12	14	6	5	2	1	5
8	10	31	20	1	5	9	15	18	8	6	2	1	6
9	23	73	48	2	11	22	36	44	19	14	5	3	14
10	31	96	63	3	14	28	48	57	25	19	7	5	18
11	24	51	33	2	11	17	26	30	21	14	9	10	14
12	42	31	20	1	21	17	20	18	41	25	28	36	27
13	106	38	25	2	55	33	33	23	107	64	77	104	70
14	175	46	30	2	90	51	46	27	176	105	129	175	115
15	185	62	41	5	99	59	56	37	188	113	136	184	124
16	131	82	59	17	96	67	67	56	135	84	101	127	99
17	85	77	97	77	156	126	110	114	96	85	130	106	121
18	71	91	182	172	179	197	175	223	73	128	201	108	159
19	59	70	127	139	88	119	109	141	34	95	109	54	88
20	14	37	48	86	43	51	40	38	14	63	23	20	33
21	15	46	46	79	43	50	40	32	16	66	13	19	31
22	12	37	37	68	35	42	34	27	13	53	10	15	25
23	17	52	45	60	25	38	41	37	15	36	9	11	22
24	9	28	28	54	13	25	29	24	8	16	5	7	13
25	3	9	14	51	5	16	19	12	3	5	2	4	6
26	1	4	8	46	3	11	14	8	1	1	1	3	4
27	-	-	2	35	1	6	8	3	-	-	1	2	2
28	-	1	2	25	1	3	5	3	-	-	-	1	1
29	-	-	-	19	-	1	3	1	-	-	-	1	1
30	-	-	-	15	-	-	2	1	-	-	-	-	0
31	-	-	-	14	-	-	2	1	-	-	-	-	0
32	-	-	-	11	-	-	1	1	-	-	-	-	0
33	-	-	-	7	-	-	1	1	-	-	-	-	0
34	-	-	-	3	-	-	-	-	-	-	-	-	0
35	-	-	-	1	-	-	-	-	-	-	-	-	0
36													
37													
38													
39													
40													
Total ‰	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Number of samples													
Number of fish measured													
Mean length (cm)	15.10	15.47	16.77	21.45	16.93	17.53	17.18	16.86	15.20	16.97	16.32	15.89	16.49
Mean weight (g)	92	112	133	248	126	143	143	134	93	129	111	104	118
Range of depths (m)													
Mesh size (mm)													

LENGTH FREQUENCIES
(‰)

No.....

SPECIES Sepia spp.

COUNTRY JAPAN YEAR 1971 ACCREDIT REPORT TO .....

DIVISION Sahara Coastal GEAR OTTER TRAWL CATCHES/LANDINGS CATCH

RESEARCH OR COMMERCIAL FISHING COMMERCIAL FISHING REMARKS Mantle length

Length group (cm) \ Months	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
0													
1													
2													
3													
4	10	10	9	15	8	12	4	7	7	10	8	9	10
5	13	13	12	19	10	15	5	9	9	13	11	11	12
6	23	22	21	33	19	27	10	18	17	23	20	21	22
7	36	35	33	52	30	42	15	28	27	37	32	32	35
8	48	47	43	68	39	56	20	37	36	48	42	43	46
9	58	57	52	82	49	67	24	45	43	59	51	52	56
10	62	63	57	85	57	72	32	55	51	67	61	61	63
11	65	69	61	84	67	74	39	65	58	73	69	70	69
12	67	73	64	79	77	74	48	76	66	80	78	79	75
13	70	80	68	75	90	76	58	90	76	88	89	91	87
14	69	81	68	69	94	72	60	92	78	88	90	91	82
15	67	79	68	62	93	68	63	92	78	84	88	89	80
16	61	69	63	53	81	61	60	82	73	72	76	77	70
17	53	58	57	43	65	52	55	68	66	57	61	61	58
18	47	48	53	35	51	46	52	57	60	44	48	48	48
19	40	38	46	28	37	38	47	44	51	32	35	35	37
20	33	30	39	22	28	31	42	34	42	24	26	26	29
21	26	23	30	16	20	23	36	24	32	17	19	18	21
22	20	17	23	12	14	17	32	18	24	13	15	14	16
23	15	12	17	9	10	12	28	11	17	9	11	10	12
24	13	9	13	7	7	9	27	8	12	8	9	8	9
25	11	8	12	6	6	7	26	5	9	6	7	7	8
26	11	7	11	6	6	6	27	4	9	6	7	6	7
27	11	7	11	6	6	6	27	4	8	6	7	6	7
28	10	7	10	5	5	5	25	4	7	5	6	5	6
29	10	6	10	5	5	5	24	3	7	5	6	5	6
30	10	6	10	5	5	5	23	3	7	5	6	5	6
31	9	5	9	4	4	5	21	3	6	5	5	5	5
32	7	5	7	4	4	4	18	3	5	4	4	4	5
33	6	4	6	3	3	3	14	2	4	3	3	3	4
34	5	3	5	3	2	3	12	2	4	3	3	3	3
35	4	2	4	2	2	2	9	1	3	2	2	2	2
36	3	2	3	1	1	1	6	1	2	1	2	1	2
37	2	1	2	1	1	1	5	1	1	1	1	1	1
38	1	1	1	1	1	1	3	-	1	1	1	1	1
39	1	1	1	1	-	1	2	-	1	1	1	-	1
40	1	-	1	-	-	-	1	-	-	-	-	-	0
41	-	-	-	-	-	-	1	-	-	-	-	-	0
42													
43													
44													
45													
Total ‰	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Number of samples													
Number of fish measured													
Mean length (cm)	15.30	14.58	15.65	13.31	14.54	14.08	19.01	14.59	15.56	14.14	14.59	14.42	14.57
Mean weight (g)	660	553	682	456	523	510	1,100	511	636	504	545	521	551
Range of depths (m)													
Mesh size (mm)													

LENGTH FREQUENCIES
(‰)

No .....

SPECIES Sepia spp.

COUNTRY JAPAN YEAR 1971 ACCREDIT REPORT TO .....

DIVISION C.Verde Coastal GEAR OTTER TRAWL CATCHES/LANDINGS CATCH

RESEARCH OR COMMERCIAL FISHING COMMERCIAL FISHING REMARKS Mantle length

Length group (cm) \ Months	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
0													
1													
2													
3													
4	1	4	5	5	1	8	10	10	8	9	4	2	7
5	3	6	5	4	1	10	13	12	11	11	5	3	9
6	15	13	12	9	5	20	23	22	23	22	12	6	17
7	21	21	18	14	8	31	36	35	35	34	19	10	26
8	27	27	23	18	11	40	48	46	46	44	25	15	35
9	34	31	25	21	11	48	59	56	52	52	28	14	41
10	46	40	34	26	19	53	64	63	63	61	38	20	48
11	50	45	36	28	23	56	69	70	65	66	43	24	52
12	70	53	43	33	32	59	75	75	72	72	53	30	57
13	83	63	48	38	41	65	79	84	78	81	63	36	64
14	66	61	45	40	42	62	80	86	71	78	63	37	63
15	65	62	49	47	51	63	79	85	70	77	66	41	65
16	61	60	54	57	61	65	72	77	67	70	66	43	65
17	54	56	60	67	72	65	63	66	63	61	65	45	64
18	54	55	67	78	84	67	56	57	61	55	66	48	65
19	50	51	68	81	87	64	47	46	55	46	62	49	60
20	41	46	63	74	79	56	38	36	46	37	54	47	52
21	31	36	51	61	64	43	28	26	34	27	43	43	41
22	31	31	41	46	49	31	19	17	25	21	34	40	31
23	28	26	32	34	36	20	11	10	16	14	26	38	21
24	25	23	27	26	28	13	7	5	10	10	20	38	16
25	20	21	25	22	23	9	4	3	6	7	17	39	12
26	18	21	22	21	22	7	3	2	4	6	16	40	11
27	17	21	22	21	21	7	3	1	3	6	16	41	11
28	14	19	20	19	19	6	2	1	2	5	14	38	10
29	14	19	19	19	19	6	2	1	2	5	14	38	10
30	14	18	18	18	18	6	2	1	2	4	13	35	9
31	13	16	17	16	16	5	2	1	2	4	12	31	8
32	10	14	14	14	14	4	2	1	1	3	10	27	7
33	9	11	12	11	11	4	1	1	1	3	8	22	6
34	8	9	10	9	9	3	1	1	1	2	7	18	5
35	5	7	7	7	7	2	1	0	1	2	5	14	4
36	4	5	5	5	5	2	1	-	-	1	4	10	3
37	3	4	4	4	4	1	-	-	-	1	3	7	2
38	2	2	2	2	2	1	-	-	-	1	2	5	1
39	1	2	2	2	2	1	-	-	-	-	1	4	1
40	1	1	1	1	1	-	-	-	-	-	1	2	1
41	1	1	1	1	1	-	-	-	-	-	1	2	0
42	-	-	-	-	-	-	-	-	-	-	-	1	0
43													
44													
45													
total ‰	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Number of samples													
Number of fish measured													
Mean length (cm)	17.30	17.92	18.74	19.19	19.66	15.58	14.09	13.90	14.46	14.63	17.51	21.67	16.31
Mean weight (g)	858	954	1,031	1,061	1,093	634	471	457	500	538	868	1,463	728
Range of depths (m)													
Mesh size (mm)													

LENGTH FREQUENCIES
(‰)

No .....

SPECIES Sepia spp.

COUNTRY JAPAN YEAR 1972 ACCREDIT REPORT TO .....

DIVISION Sahara Coastal GEAR OTTER TRAWL CATCHES/LANDINGS CATCH

RESEARCH OR COMMERCIAL FISHING COMMERCIAL FISHING REMARKS Mantle length

Length group (cm) \ Months	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
0													
1													
2													
3													
4	9	12	9	8	4	5	5	3	4	7	10	7	7
5	12	15	11	10	5	7	7	5	5	9	13	9	9
6	23	28	20	18	9	13	13	10	12	19	24	16	17
7	36	44	32	29	15	21	21	16	19	30	37	26	27
8	47	57	42	38	21	29	27	21	25	39	49	35	36
9	56	69	51	47	27	37	34	26	28	46	59	43	44
10	64	75	57	55	39	48	41	37	39	57	67	54	55
11	69	77	62	63	56	62	49	49	45	66	72	66	65
12	76	78	67	71	75	79	57	64	56	77	79	80	74
13	85	80	74	83	99	100	68	82	67	90	86	97	87
14	81	75	76	86	109	107	71	88	66	88	83	101	89
15	78	71	76	86	112	108	74	92	70	87	80	101	89
16	68	62	70	77	98	94	69	86	70	76	70	87	79
17	56	51	62	66	80	75	63	77	69	63	58	69	66
18	47	43	55	56	62	58	58	69	70	52	48	52	55
19	36	35	47	45	45	42	51	58	65	40	38	37	43
20	28	27	38	36	33	30	43	48	56	31	29	27	34
21	21	20	29	27	24	21	34	36	44	22	21	18	25
22	17	15	22	19	17	15	27	26	34	18	16	14	18
23	13	11	15	13	11	9	21	18	24	13	11	10	13
24	10	8	11	9	8	6	18	13	18	10	8	7	10
25	8	6	9	7	6	4	16	10	14	8	6	6	8
26	8	6	8	6	6	4	16	9	13	7	5	5	7
27	8	5	8	6	6	4	16	8	13	7	5	5	7
28	7	5	7	6	5	3	15	7	11	6	4	4	6
29	7	5	7	6	5	3	15	7	11	6	4	4	6
30	6	4	7	5	5	3	14	7	10	5	4	4	5
31	6	4	6	5	4	3	12	6	9	5	3	4	5
32	5	3	5	4	4	2	11	5	8	4	3	3	4
33	4	3	4	3	3	2	9	4	6	3	2	3	3
34	3	2	4	3	2	2	7	4	6	3	2	2	3
35	2	2	3	2	2	1	5	3	4	2	1	2	2
36	2	1	2	1	1	1	4	2	3	1	1	1	2
37	1	1	1	1	1	1	3	1	2	1	1	1	1
38	1	1	1	1	1	-	2	1	1	1	-	1	1
39	1	-	1	1	-	-	1	1	1	1	-	-	1
40	-	-	-	-	-	-	1	-	1	-	-	-	0
41	-	-	-	-	-	-	1	-	-	-	-	-	0
42													
43													
44													
45													
total ‰	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Number of samples													
Number of fish measured													
Mean length (cm)	14.62	15.81	15.19	14.95	15.40	14.69	17.12	16.27	17.05	14.93	14.07	14.60	15.01
Mean weight (g)	561	482	612	566	572	501	840	679	791	557	485	516	570
Range of depths (m)													
Mesh size (mm)													

Appendix 6

DATA ON EFFECTS OF CHANGES IN MESH SIZE IN THE CEPHALOPOD FISHERY

by

I. IKEDA
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Table 1

Species and size composition of catches made by some trawlers fishing mainly for cephalopods (May-June 1971)

1 Sahara Coastal Division

	Total	Pagellus bellotti	Cuttle-fishes	Squid	Octopus	Others
Catch (tons)	23.6	1.1	12.1	1.5	3.2	5.6
Catch (%)	100.0	4.9	51.2	6.2	13.8	23.9
Catch in number (10^3)	-	8.4	43.0	-	2.6	-
Size Class: For sparids and Sepia	For octopus					
7-	15-		1	Not available	2	
8	20		6		5	
9	25		46		15	
10	30		153		36	
11	35		262		60	
12	40		233		76	
13	45		114		83	
14	50		52		94	
15	55	10	39		101	
16	60	74	25		97	
17	65	201	17		86	
18	70	270	12		81	
19	75	252	10		78	
20	80	135	8		67	
21	85	43	6		52	
22	90	12	5		35	
23	95	3	3		20	
24	100		2		8	
25	105		2		3	
26	110		1		1	
27			1			
28			1			
29			1			
Total		1,000	1,000		1,000	

Fork length for Pagellus bellotti, mantle length for cuttlefishes and total length for octopus.
Size composition is estimated from subsamples.

(continued)

Table 1

(Continued)

2 Cape Verde Coastal Division

	Total	Pagellus bellotti	Cuttle-fishes	Squid	Octopus	Others
Catch (tons)	347.8	9.4	97.5	0.7	24.7	215.5
Catch (%)	100.0	2.7	28.0	0.2	7.1	62.0
Catch in number (10^3)	-	67.7	82.3	-	20.4	-
Size Class						
For Sparids and Sepia	For Octopus					
7-	15-			Not available	1	
8	20				2	
9	25				5	
10	30		1		10	
11	35		2		17	
12	40		4		26	
13	45		10		43	
14	50	1	28		72	
15	55	13	43		112	
16	60	97	54		150	
17	65	248	63		161	
18	70	260	72		143	
19	75	177	98		111	
20	80	93	93		71	
21	85	46	103		40	
22	90	31	100		20	
23	95	19	79		10	
24	100	9	75		4	
25	105	3	68		1	
26	110	1	44		1	
27		1	25			
28		1	20			
29			15			
30			9			
31			3			
32			1			
Total		1,000	1,000		1,000	

Table 2

Reduction of cephalopod catches resulting
from change of allowable by-catch of sparids

a) Changes in cephalopod catch (%) resulting from an increase to 70 mm of present mesh sizes

Division	Sahara Coastal		Cape Verde Coastal		Remarks
Present mesh size	30 mm	50 mm	30 mm	50 mm	
Cuttlefishes					
No. of reduction	32.7	22.7	6.6	4.7	
In weight	25.2	17.8	4.2	2.9	From Table 1
No. of reduction	24.2	16.7	21.8	15.4	
In weight	10.7	7.3	8.6	6.0	From Table 3
Squid					
No. of reduction	38.7	31.7			
In weight	18.2	15.0	?	?	From Table 4
Octopus					
No. of reduction	?	?	?	?	

b) Catches of sparids and cephalopods by month and by size of trawlers (1972)

Sahara Coastal Division

Month	Total			Less 550 tons			550-2 000 tons			Over 2 000 tons		
	Total	Spar	Ceph	Total	Spar	Ceph	Total	Spar	Ceph	Total	Spar	Ceph
Total	80 409	15.6	62.3	24 987	7.0	80.5	45 908	16.7	57.7	9 514	32.8	36.9
Jan	8 050	21.5	60.1	2 120	13.3	75.7	5 209	21.6	58.7	721	44.0	24.1
Feb	6 773	12.6	68.7	1 821	3.0	83.6	4 090	12.8	67.6	676	32.1	42.5
Mar	5 314	6.8	77.7	1 086	2.0	90.0	3 592	5.3	77.7	637	22.8	57.1
Apr	4 963	16.0	64.8	814	10.7	82.6	3 214	12.1	69.7	936	34.0	32.8
May	4 909	10.5	70.4	1 039	2.8	87.0	3 407	10.7	68.3	463	26.3	48.8
June	5 799	12.2	68.3	1 850	4.6	85.4	3 316	15.0	60.8	633	19.1	57.0
July	6 891	10.1	66.0	2 567	4.1	81.3	3 694	13.7	56.9	630	14.4	56.3
Aug	10 832	10.9	69.5	3 752	2.4	91.8	5 305	11.1	64.7	1 775	28.2	36.5
Sept	6 966	19.9	49.4	2 052	6.6	78.1	3 777	20.8	41.9	1 137	40.4	22.6
Oct	6 173	20.6	47.5	2 235	11.0	67.2	3 379	23.3	38.5	560	43.4	23.6
Nov	6 648	16.5	60.3	2 647	7.5	81.6	3 585	21.9	46.6	416	27.4	43.3
Dec	7 093	27.2	47.8	3 005	13.5	68.1	3 341	33.3	35.9	746	54.7	19.6

(continued)

Table 2

(Continued)

Cape Verde Coastal Division

Month	Total			Less 550 tons			550–2 000 tons			Over 2 000 tons		
	Total	Spar	Ceph	Total	Spar	Ceph	Total	Spar	Ceph	Total	Spar	Ceph
Total	19 065	22.1	49.4	5 557	11.0	66.9	7 834	21.4	45.7	5 674	34.0	37.3
Jan	610	5.1	75.1	503	3.2	80.1	108	13.0	51.9		-	
Feb	319	2.8	82.8	290	0.7	87.2	30	26.7	40.0		-	
Mar	1 210	13.9	66.9	741	6.2	79.8	469	26.0	46.5		-	
Apr	1 693	28.5	46.1	543	3.1	75.9	654	24.2	51.5	495	62.4	6.7
May	2 883	15.5	61.0	832	3.4	74.5	972	10.7	64.1	1 079	29.1	47.9
June	2 249	23.4	43.9	388	23.7	39.7	1 089	27.1	30.3	771	18.0	65.2
July	3 097	22.2	45.8	240	24.2	44.2	1 506	21.6	41.2	1 351	22.6	51.1
Aug	1 008	16.2	6.0	204	11.8	62.3	316	9.2	66.5	488	22.5	55.3
Sept	1 787	18.1	63.1	565	4.8	85.3	818	13.6	67.8	403	46.7	22.3
Oct	1 381	32.9	34.8	327	5.8	67.0	618	21.2	40.1	436	66.1	2.8
Nov	1 040	24.5	28.4	409	19.8	34.7	414	14.7	36.7	218	50.9	0.9
Dec	1 788	24.3	51.6	516	36.4	40.3	840	37.5	26.7	432	38.0	0.5

Total catch in tons, catches for sparids and cephalopods in percentages

Table 3

Change in cuttlefish catch resulting from an increase in mesh size

Mesh size in effect: Incomplete data, two cases are assumed, i.e. 30 mm and 50 mm in terms of the internal mesh size

New mesh size: 60 mm

Selection factor: Possibly 1.63

Selection curve: Logit = 0.135 (Mantle length) - 1.4269

Size compositions: Shown in Fig. 1 for each Division in 1971 and 1972

Size Class	Body Weight	Sahara Coastal Div.			C. Verde Coastal Div.		
		Freq.	No. of Escapements		Freq.	No. of Escapements	
			30 mm	50 mm		30 mm	50 mm
Less 6	25	16	9	5	14	9	5
6	39	17	9	5	18	10	5
7	58	27	13	7	27	13	7
8	81	36	16	9	35	16	9
9	111	44	18	10	39	16	9
10	146	53	19	10	51	18	10
11	187	63	20	10	54	17	9
12	235	74	19	10	64	16	9
13	291	87	18	10	72	15	8
14	354	89	15	11	66	11	8
15	425	89	12	6	67	9	5
16	506	79	7	2	66	6	2
17	594	66	6	3	64	6	3
18	693	55	4	2	65	5	2
19	798	43	2	1	61	3	2
20	919	34	1	1	52	2	1
21	1 048	25	1		39	1	
22	1 185	18	1		31	1	
23	1 338	13			22		
24	1 499	10			16		
25	1 672	8			11		
26	1 858	7			9		
27	2 059	7			9		
28	2 269	6			7		
29	2 495	6			7		
30	2 736	5			7		
over 31		22			28		
Total in number		1 000	190	107	1 000	174	94
Total in weight		570.8	45.9	23.5	669.0	47.5	21.7
Rate of reduction in weight (%)			8	4		7	3

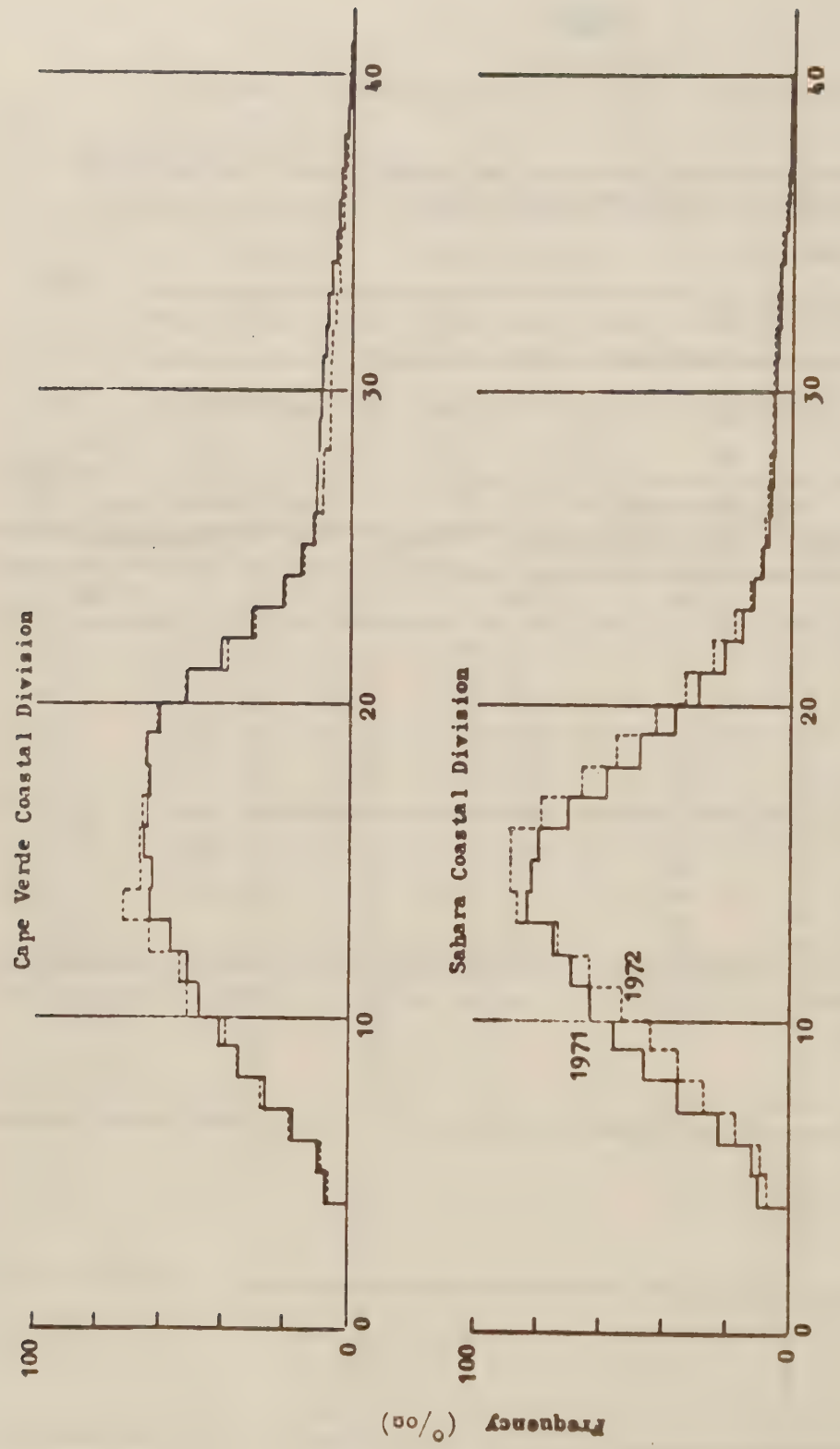

Fig. 1 Size compositions of cuttlefishes in Cape Verde and Sahara Coastal Divisions in 1971 and 1972.

Table 4

Change of squid catch resulting from an increase of mesh

Mesh size in effect: Incomplete data, two cases are assumed, i.e. 30 mm and 50 mm in terms of the internal mesh size

New mesh size: 60 mm

Selection factor: 1.92

Selection curve: Logit = 0.2003 (mantle length)-2.2292

Size composition: Representative catch by Japanese trawlers is not available

Data measured by scientist on board the trawlers during August-November in 1972 are tentatively used for calculation

Size Class	Body Weight	Frequency	Number of Escapements From 30 mm	From 50 mm
Less 5	5	29	25	15
5	10	14	12	7
6	15	20	16	10
7	22	26	20	12
8	29	32	23	14
9	38	41	26	16
10	48	47	26	16
11	59	56	26	16
12	72	64	24	15
13	86	67	19	12
14	102	72	16	9
15	119	71	11	7
16	138	71	8	5
17	158	66	5	3
18	180	62	3	2
19	204	56	2	1
20	230	46	1	1
21	257	40	1	
22	286	31		
23	317	25		
24	349	19		
25	383	15		
26	420	10		
27	458	8		
28	498	5		
29	540	3		
30	584	2		
31	630	1		
32	678	1		
Total in number		1 000	264	161
Number of fish measured		912		
Total in weight		142.6	15.0	9.1
Rate of reduction in weight (%)			10.5	6.4

Table 5

Selectivity of mesh size for octopus (1972)

No. of Trawl	Internal mesh size (mm)	Individuals of octopus caught	Individuals in codend	Retention rate
T 53	41.1	4	4	100
T 62	40.3	1	1	100
T 69	42.7	3	3	100
T 70	42.8	3	3	100
Sub-total		11	11	100
T 12	65.2	3	3	100
T 33	65.1	3	1	33
T 55	65.2	2	2	100
T 63	67.3	1	0	0
T 68	65.1	2	2	100
T 71	64.4	3	3	100
T 77	66.2	5	1	20
Sub-total		19	12	63
T 35	76.5	1	0	0
T 52	78.2	3	3	100
T 72	74.9	4	2	50
T 75	77.2	1	0	0
Sub-total		9	5	56
T 57	94.6	2	0	0
T 64	95.8	1	0	0
T 67	95.5	1	0	0
T 73	97.9	6	1	17
T 74	98.0	1	0	0
Sub-total		11	1	9

* * * * * *

Appendix 7

REPORT ON THE NORWEGIAN PELAGIC FISHERY OFF WEST AFRICA (1970 - 1973)

by

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In a report on the Norwegian pelagic fishery off West Africa in 1970 and 1971, only summary catch statistics for 1971 were given (Østvedt 1972). During October–November 1972 and June–July 1973, by the courtesy of A/S Thor Dahl, Mr. S. Myklevoll had the opportunity to work on board ASTRA to compile past catch statistics and to secure samples for biological studies. All the data given in the present report from the ASTRA expedition are based on log books on board the factory vessel. It has been possible to get corrected catch data for 1970, 1971 and 1972. For 1973 only the spring season is included.

Catch statistics for the Norwegian expedition NORGLOBAL have been made available for the report as well but, as a consequence of the extended fishing limits by some West African countries in 1972, NORGLOBAL left the area by December 1972, and during the latter part of the year fishing was restricted to the coast of Spanish Sahara while the ASTRA expedition, under an agreement with the Government of Mauritania, continued operations in that area.

FISHING AREA

It is presumed that as far as possible the factory vessels keep within the same area as the purse seiners. The location of the ASTRA at noon every day and the number of fishing days by statistical squares during the fishing seasons in the years 1970 to July 1973 are shown in Fig. 1 - 8. The seasonal variation in fishing areas follows the same trend in all years, except in the first half of 1973 when fishing was prohibited on the fishing grounds off the coast of Senegal.

As appears from the figures, during January and February the fishing has been concentrated mainly in the area south of Cape Blanc, while during March, April and May the fleet has generally moved south of Cape Verde and northward again by the end of May, reaching the most northerly fishing area about 24°00'N in August–September.

For the NORGLOBAL expedition information about fishing areas are available only from December 1970 to September 1972 as shown in Fig. 9 - 12 giving the noon position of the factory vessel and the number of fishing days by statistical squares. The NORGLOBAL expedition operated in about the same areas as the ASTRA expedition until June 1972.

CATCH STATISTICS

Catch Statistics for the ASTRA expedition in 1970 were given in an earlier report (Østvedt 1972). For some months the catch data were incomplete, and corrected data are therefore given in Tables 1 and 2. The total catch for 1970, including March and December, was 90 672 tons. December gave the highest catch per fishing day but, as the fleet had already closed the season on 5 December, this figure is hardly comparable with those for the other months.

As a whole the period October - December yielded the highest catch per fishing day with nearly 70 tons as compared with only 20 tons in August. The catch statistics for the ASTRA expedition in 1971, 1972 and the first half of 1973 are given in Tables 3 - 8. During all the years the autumn period October–December has yielded the highest catches.

Fig. 1 - THE "ASTRA" EXPEDITION 1970. POSITION AT NOON OF FACTORY VESSEL

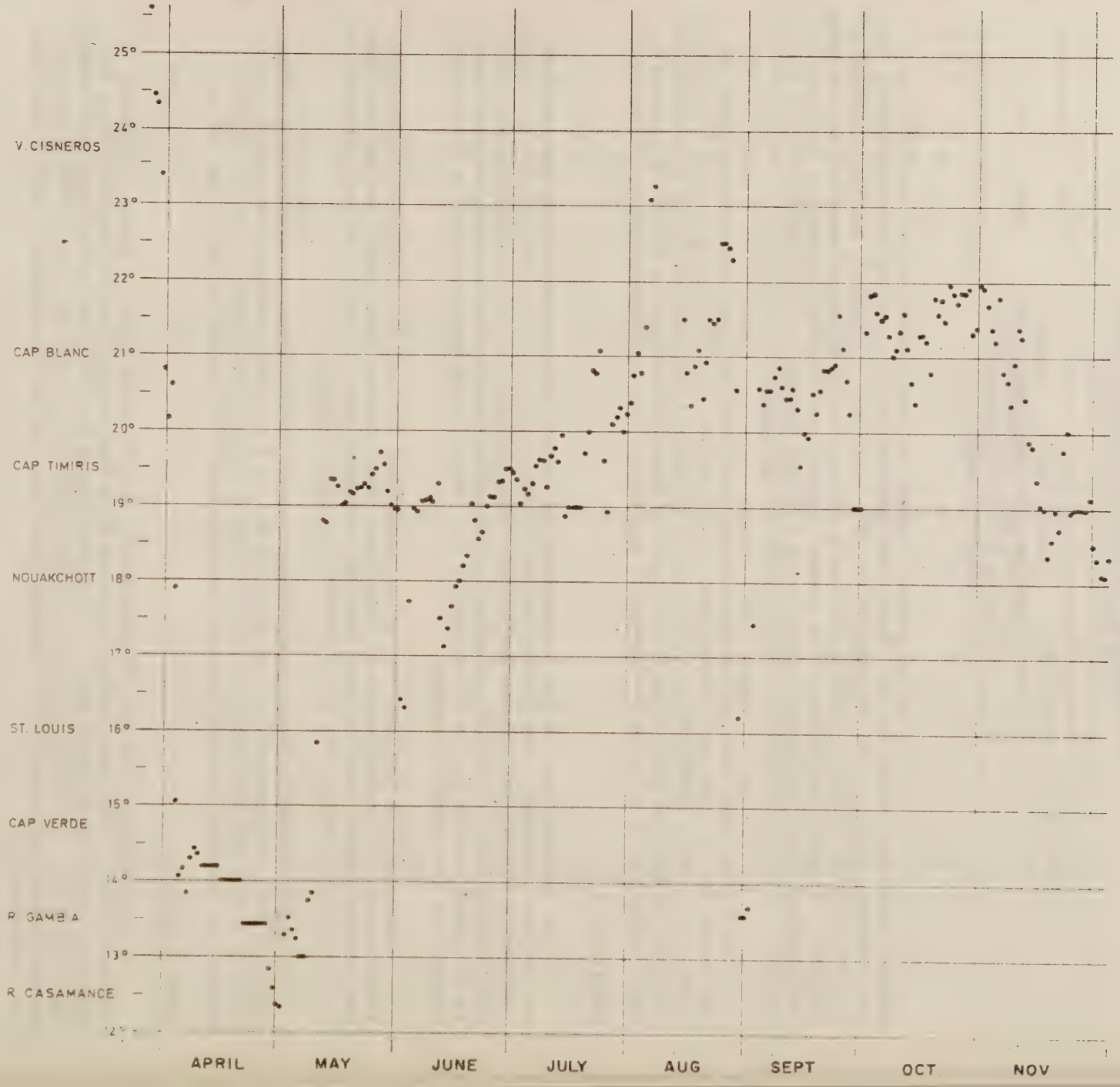


Fig. 2 - THE "ASTRA" EXPEDITION 1970. NUMBER OF FISHING DAYS BY STATISTICAL SQUARES

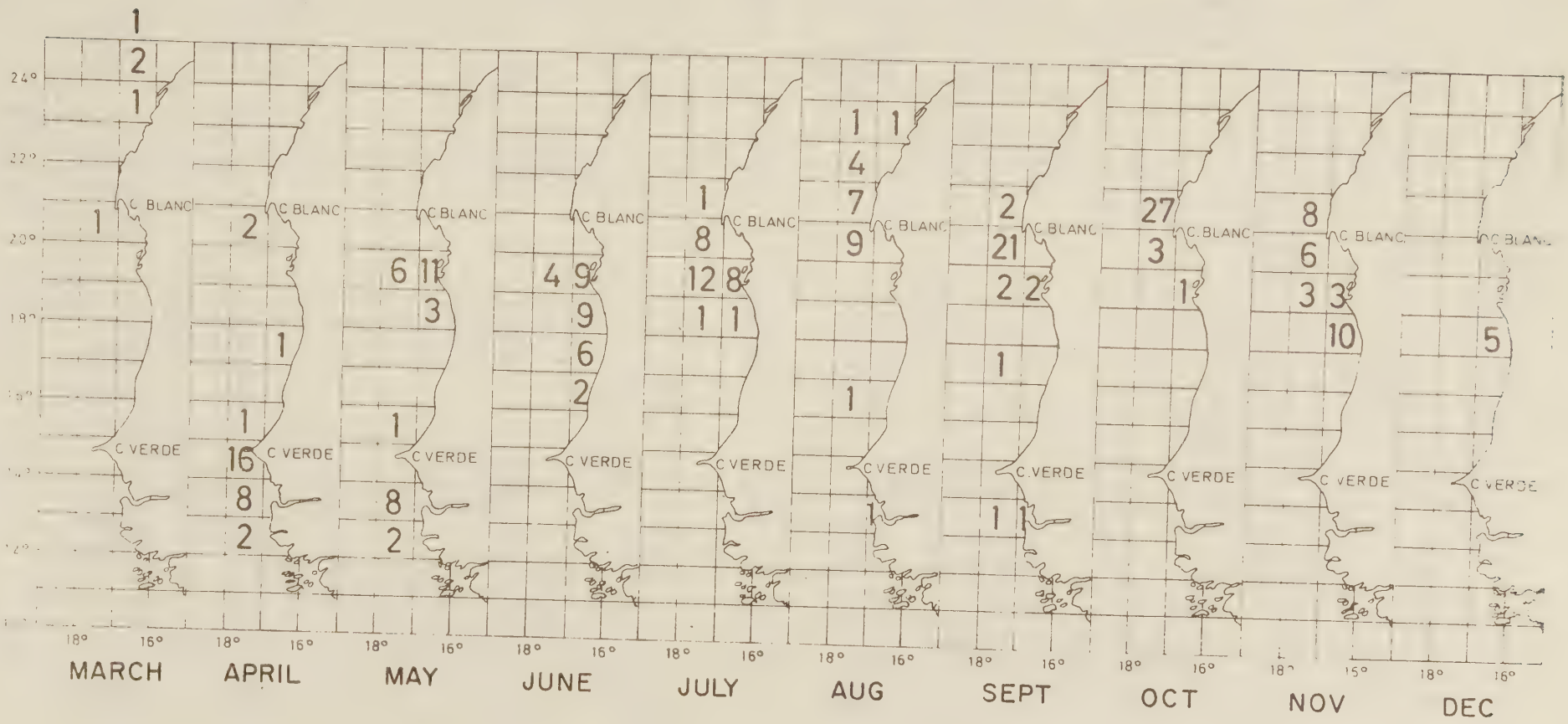


Fig. 3 - THE "ASTRA" EXPEDITION 1971. POSITION AT NOON OF FACTORY VESSEL

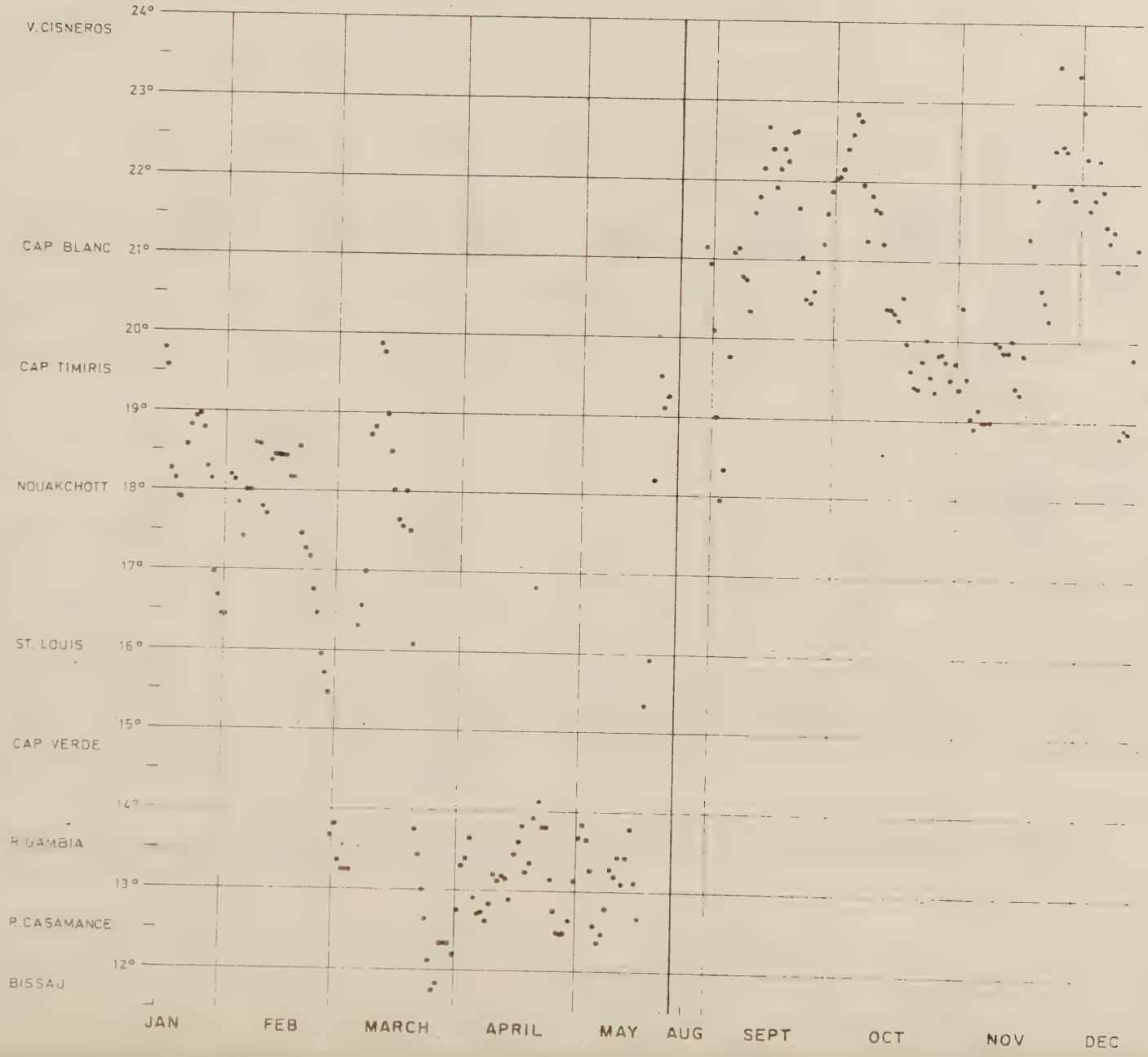
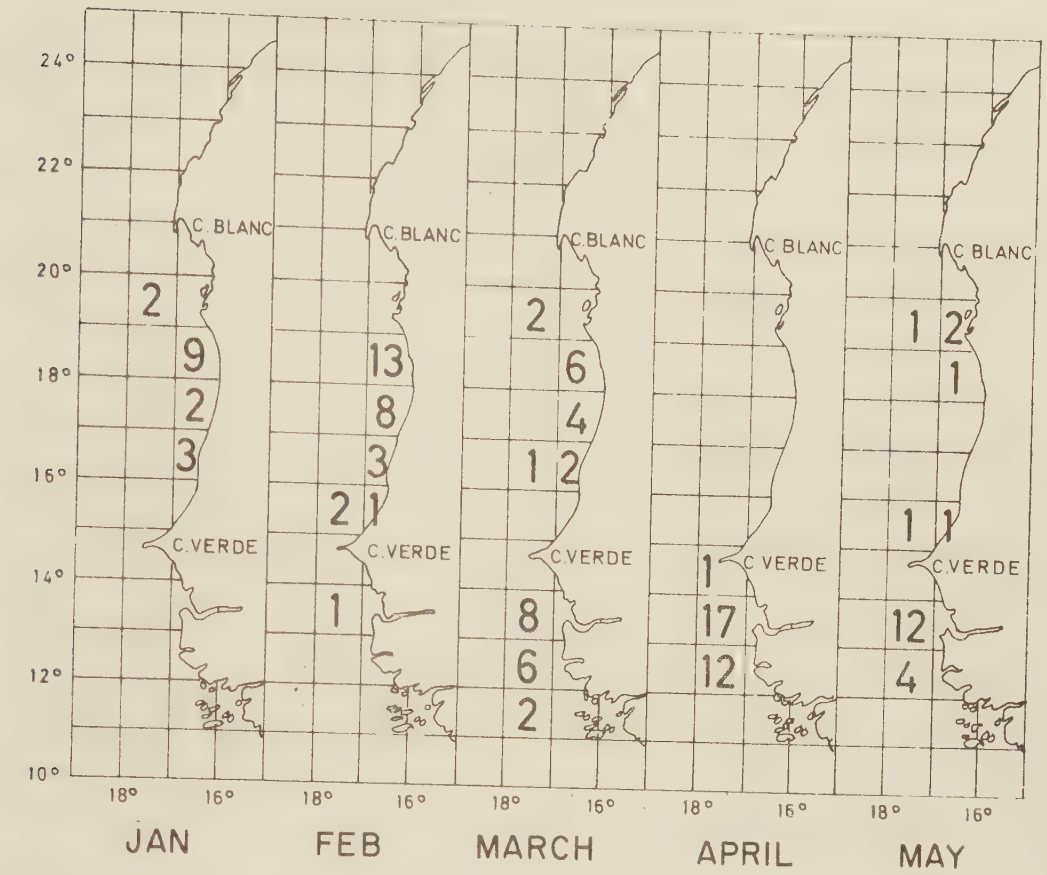


Fig. 4 - THE "ASTRA" EXPEDITION 1971. NUMBER OF FISHING DAYS BY STATISTICAL SQUARES



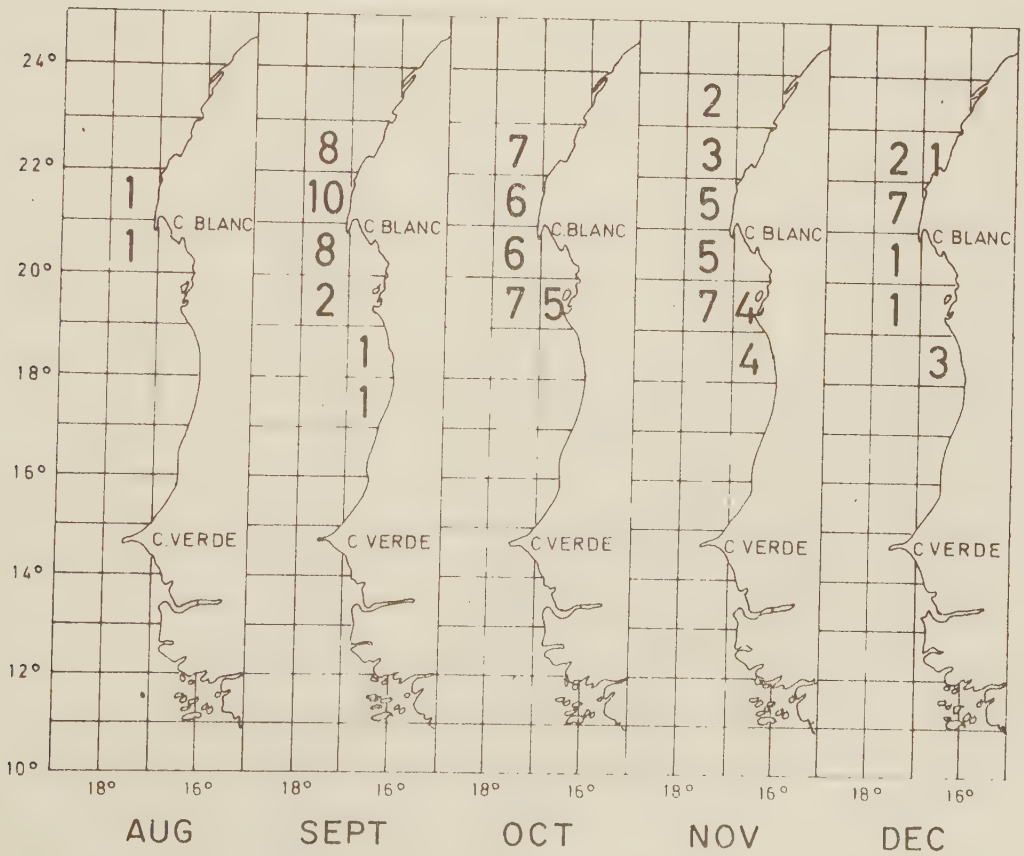


Fig. 5 - THE "ASTRA" EXPEDITION 1972. POSITION AT NOON OF FACTORY VESSEL

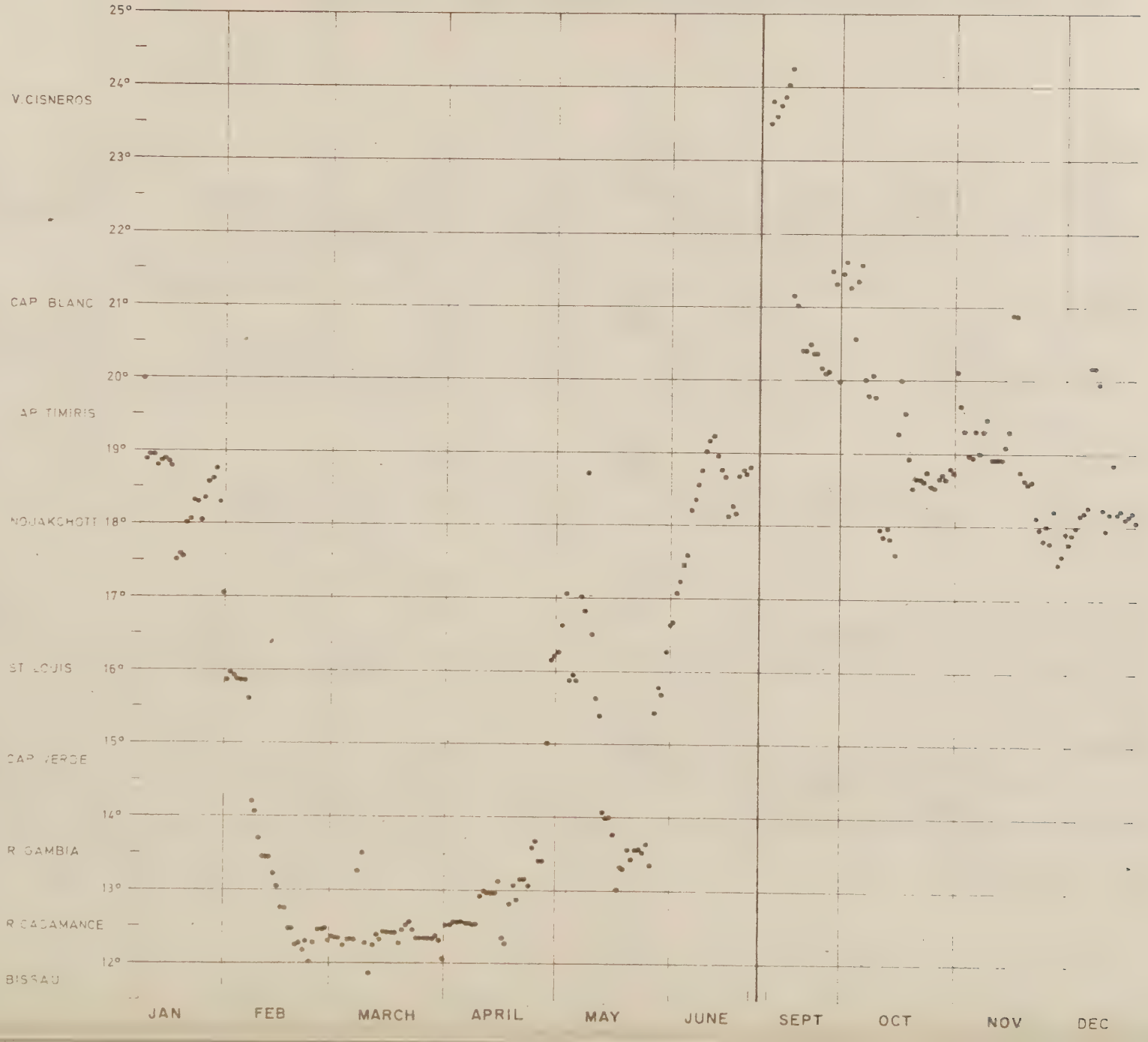
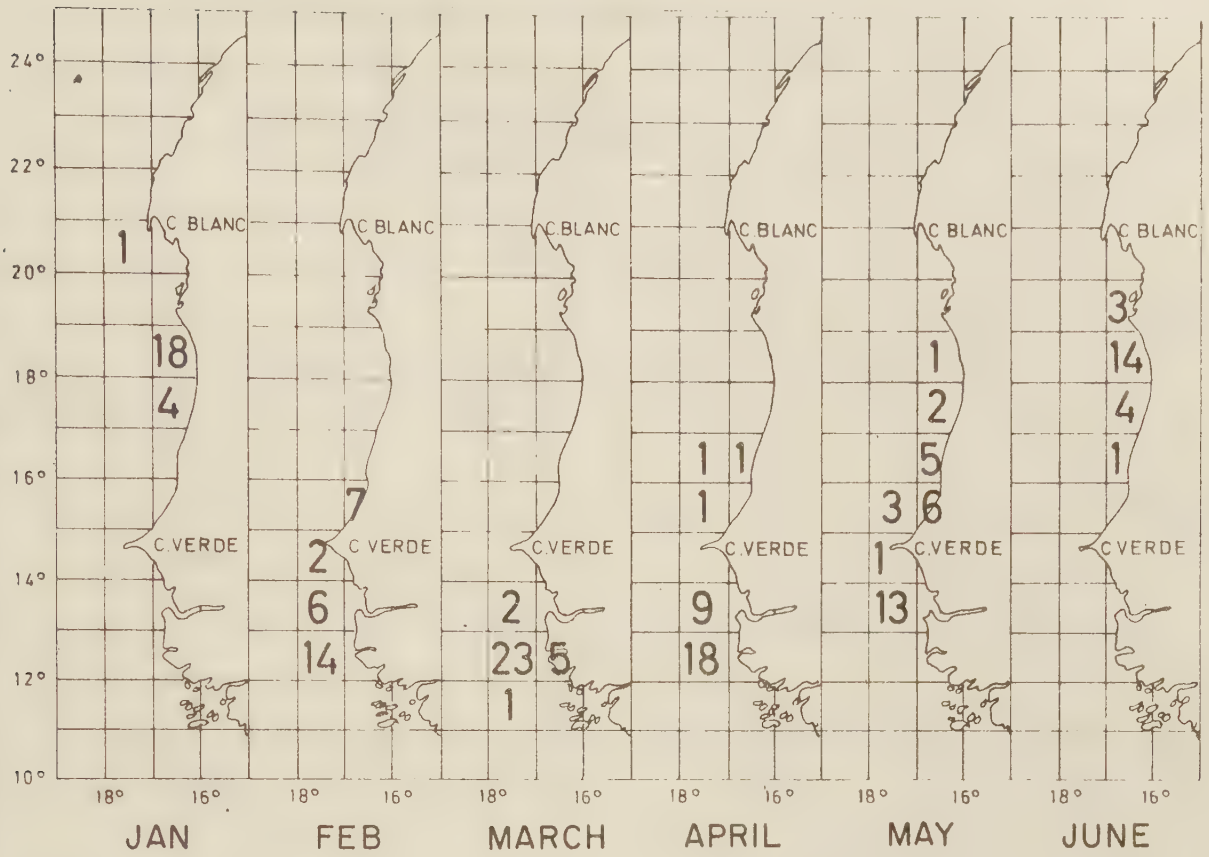


Fig. 6 - THE "ASTRA" EXPEDITION 1972. NUMBER OF FISHING DAYS BY STATISTICAL SQUARES



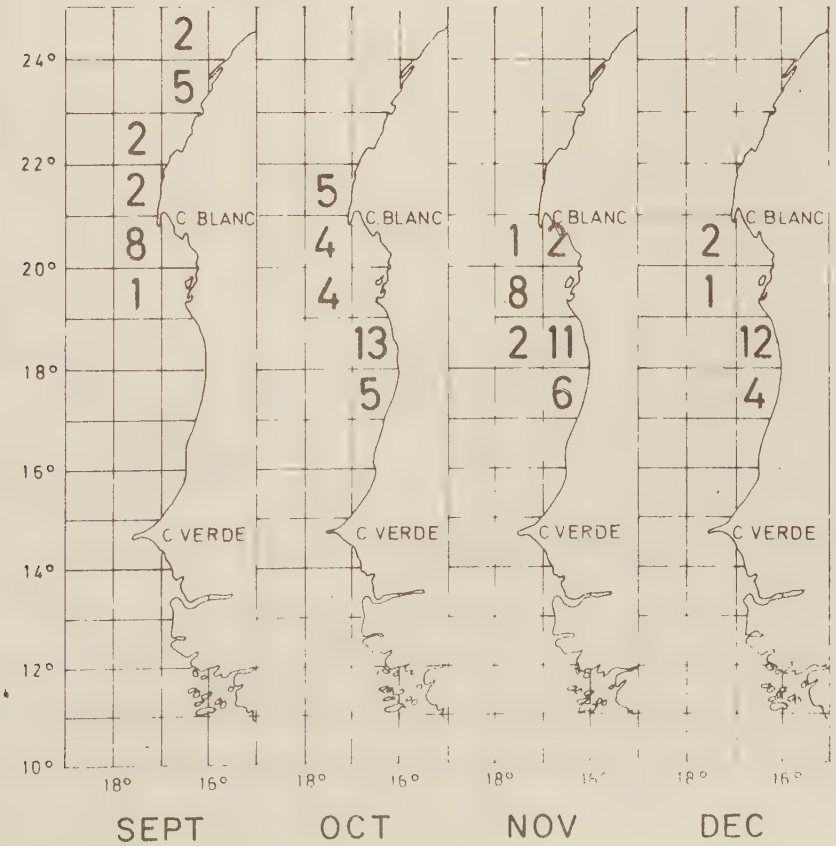


Fig. 7 - THE "ASTRA" EXPEDITION 1973. POSITION AT NOON OF FACTORY VESSEL

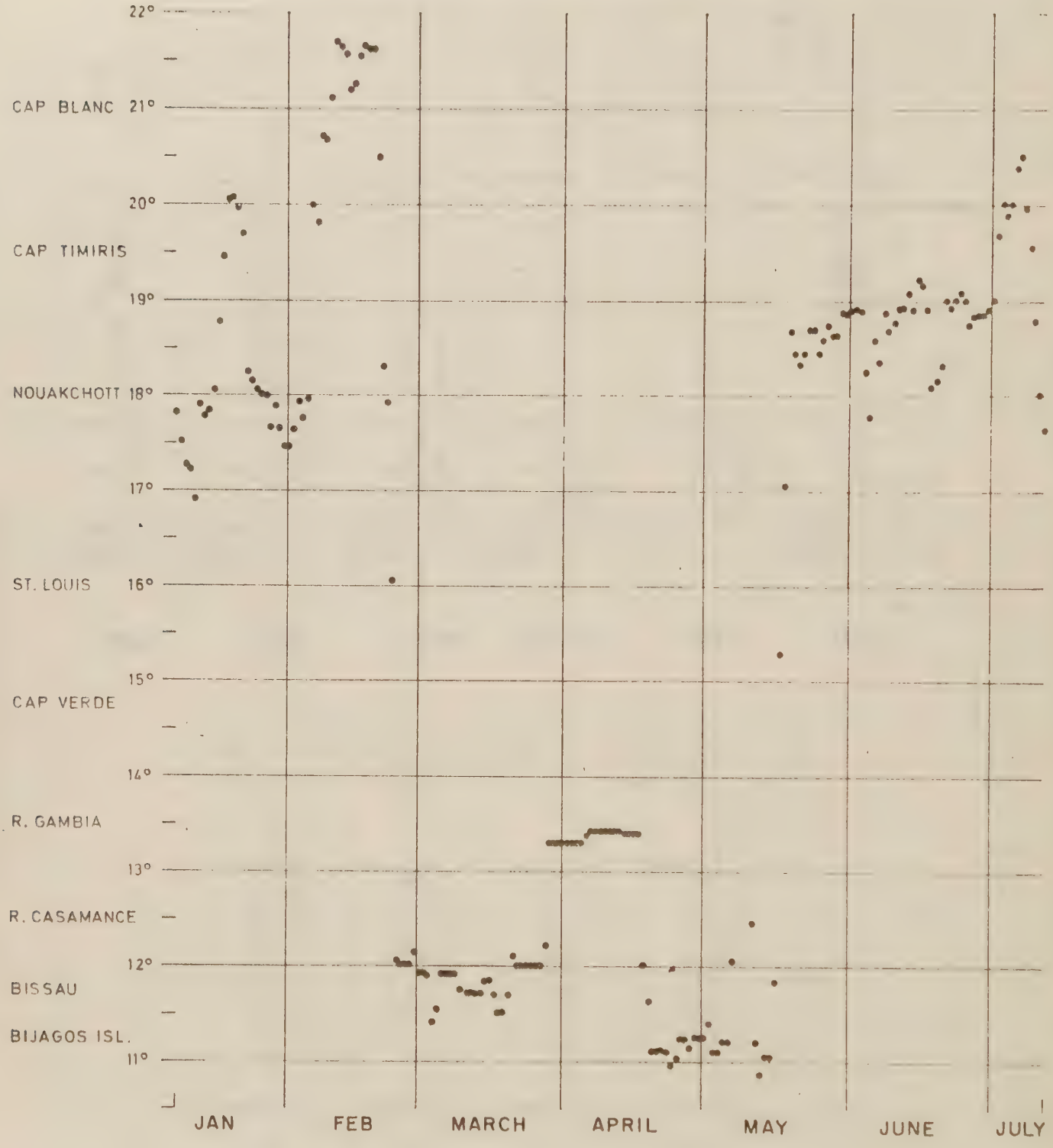


Fig. 8 - THE "ASTRA" EXPEDITION 1973 (8 JANUARY - 12 JULY, MAY: 3 DAYS IN DAKAR).
NUMBER OF FISHING DAYS BY STATISTICAL SQUARES 1° x 1°)

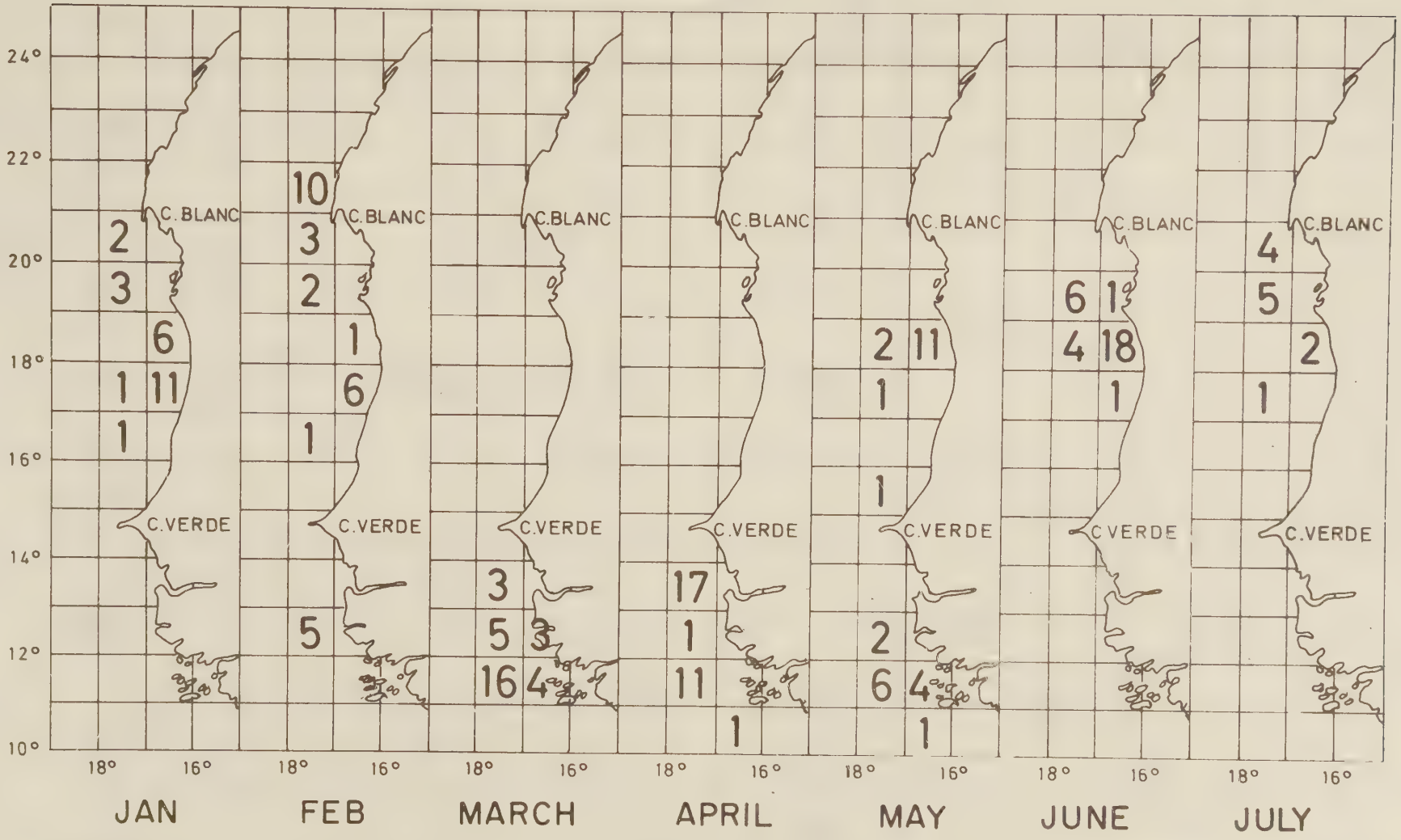


Fig. 9 - THE "NORGLOBAL" EXPEDITION 1970-1971. POSITION AT NOON OF FACTORY VESSEL

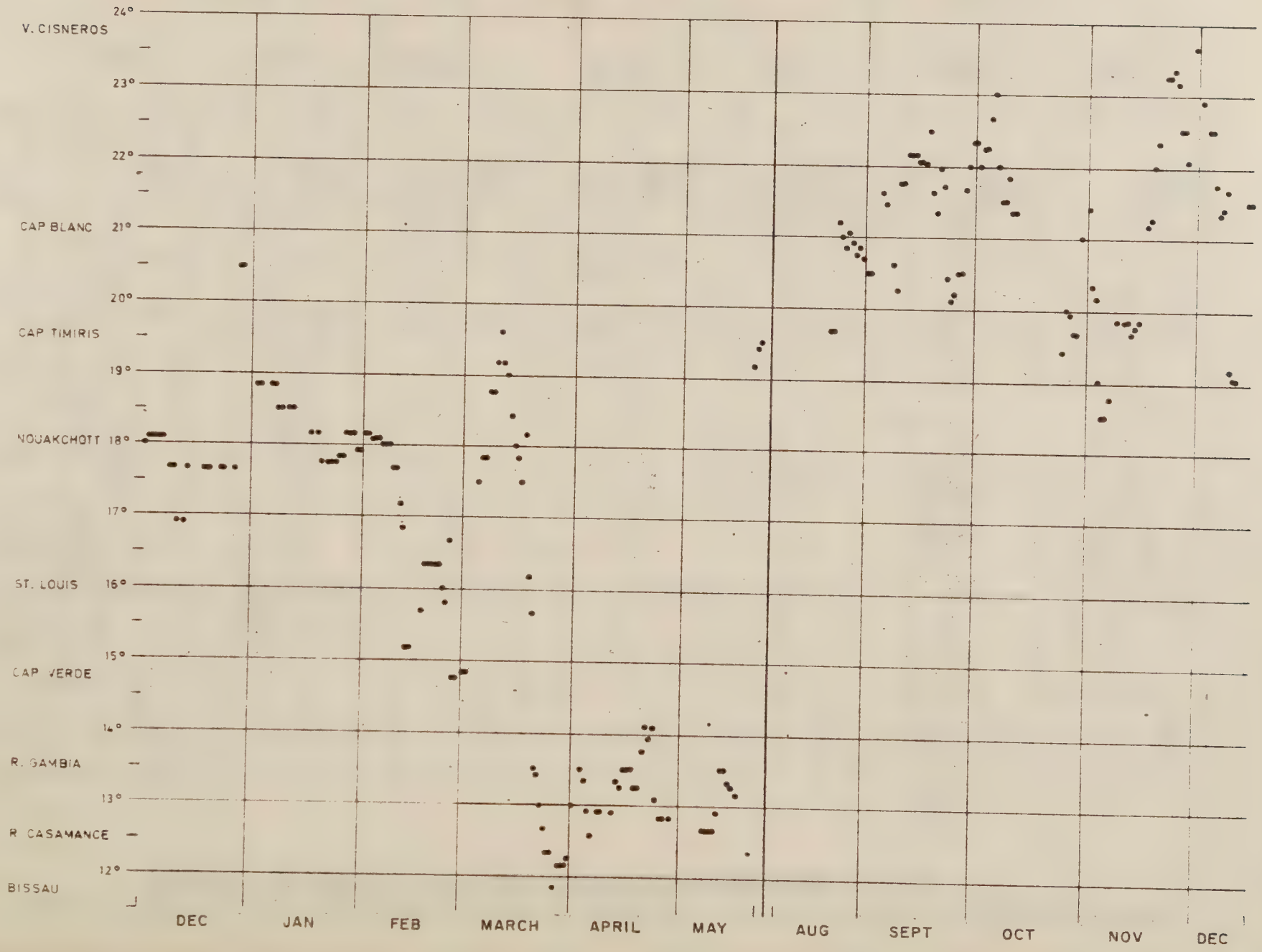
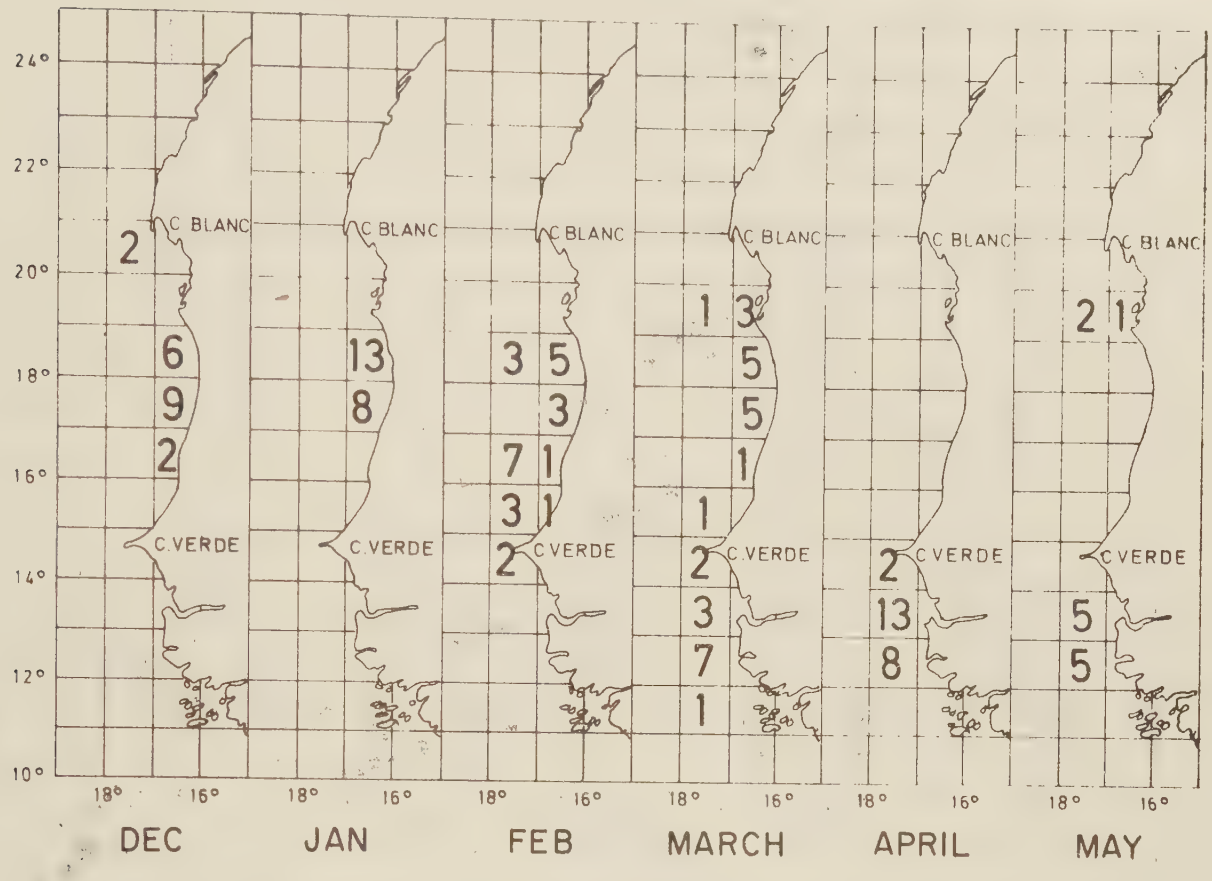


Fig. 10 - THE "NORGLOBAL" EXPEDITION 1970-1971. NUMBER OF FISHING DAYS BY STATISTICAL SQUARES (1° x 1°). ONLY DAYS WITH CATCHES INCLUDED



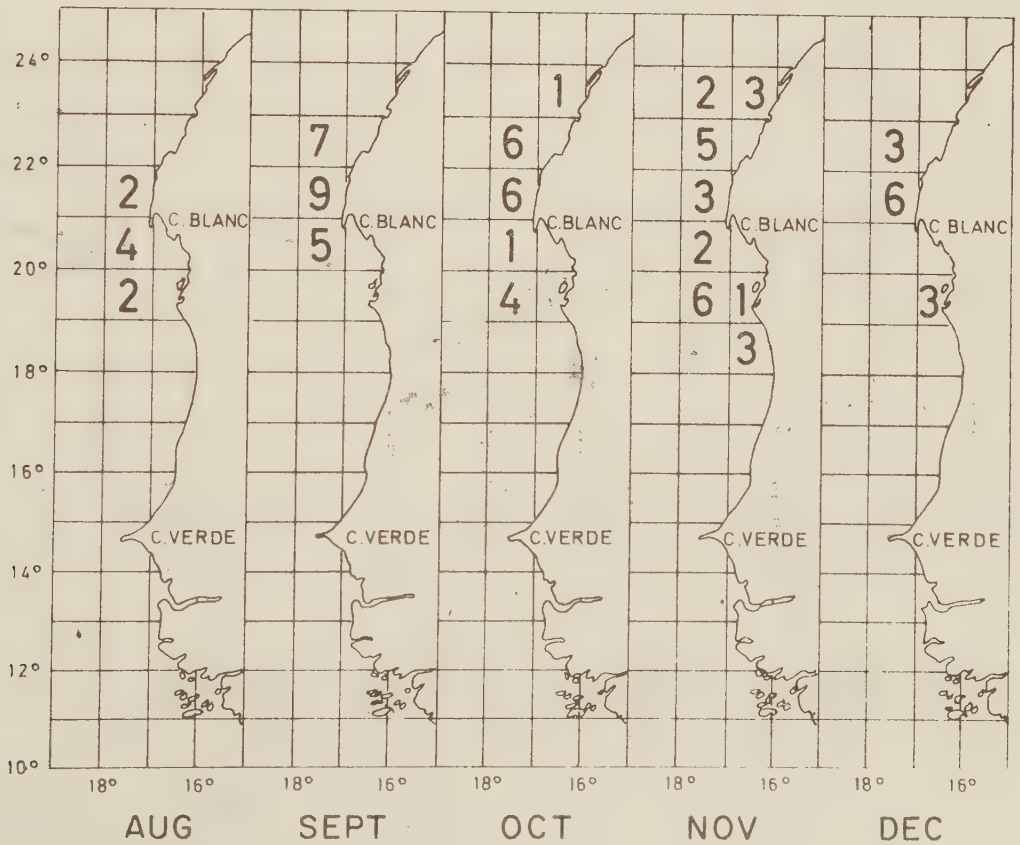


Fig. 11 - THE "NORGLOBAL" EXPEDITION 1972. POSITION AT NOON OF FACTORY VESSEL

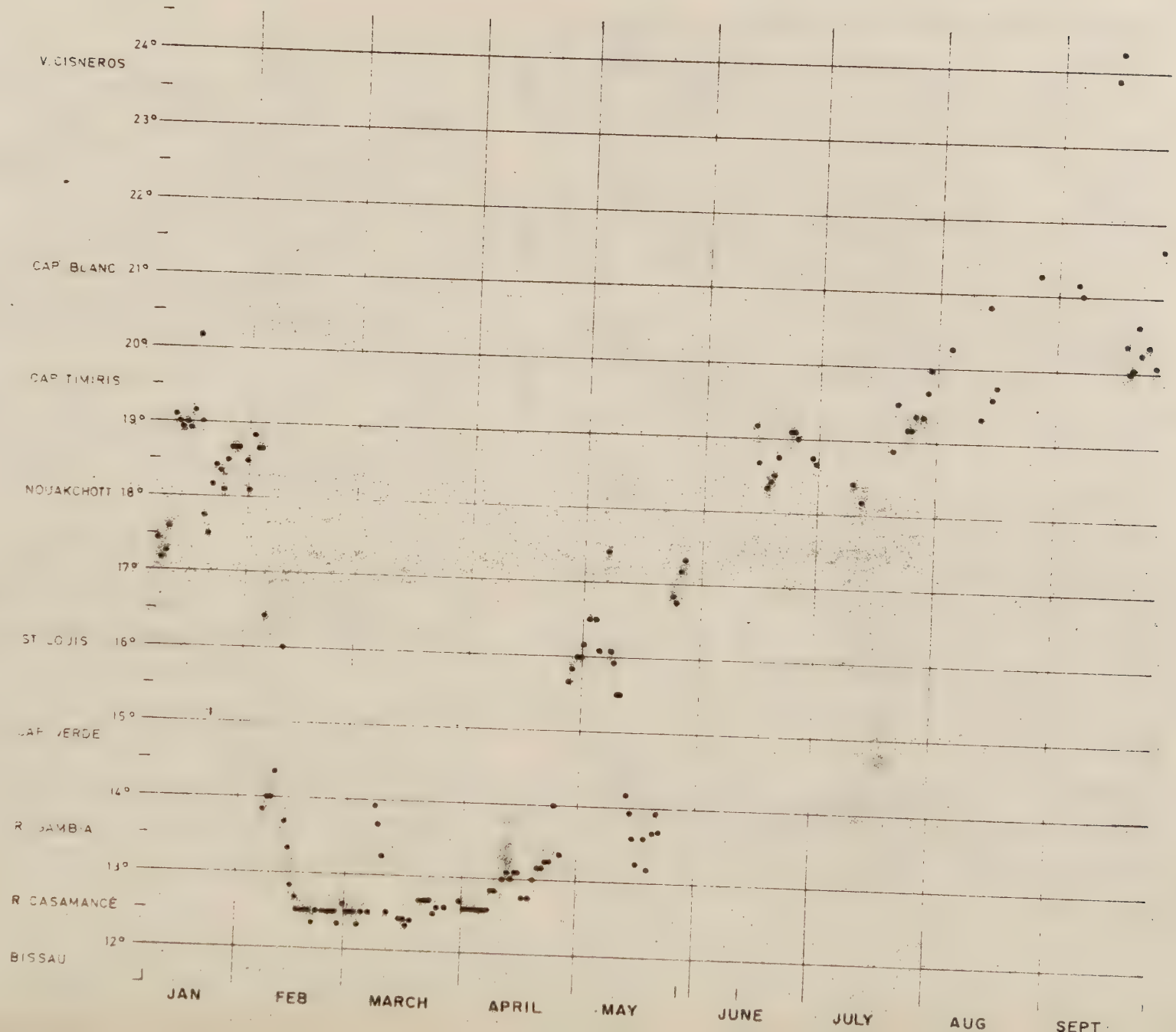
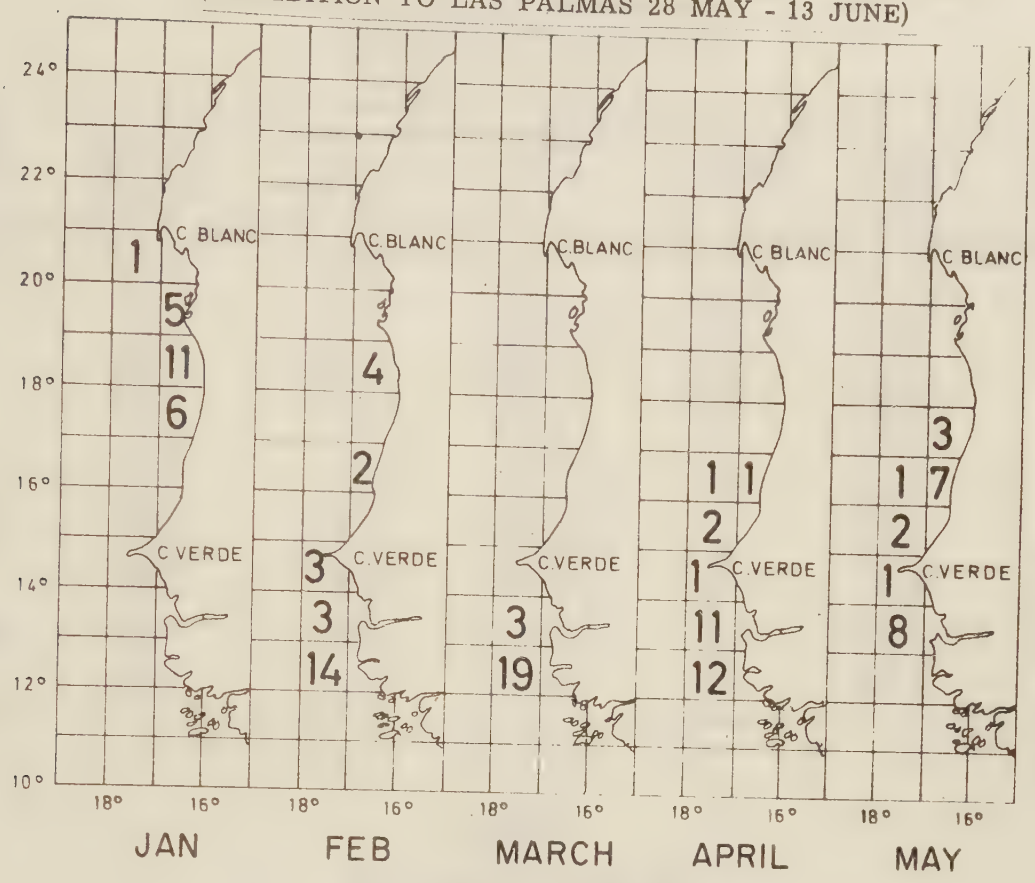


Fig. 12 - THE "NORGLOBAL" EXPEDITION 1972.
NUMBER OF FISHING DAYS BY STATISTICAL SQUARES (1° x 1°). ONLY DAYS WITH CATCHES INCLUDED.
(EXPEDITION TO LAS PALMAS 28 MAY - 13 JUNE)



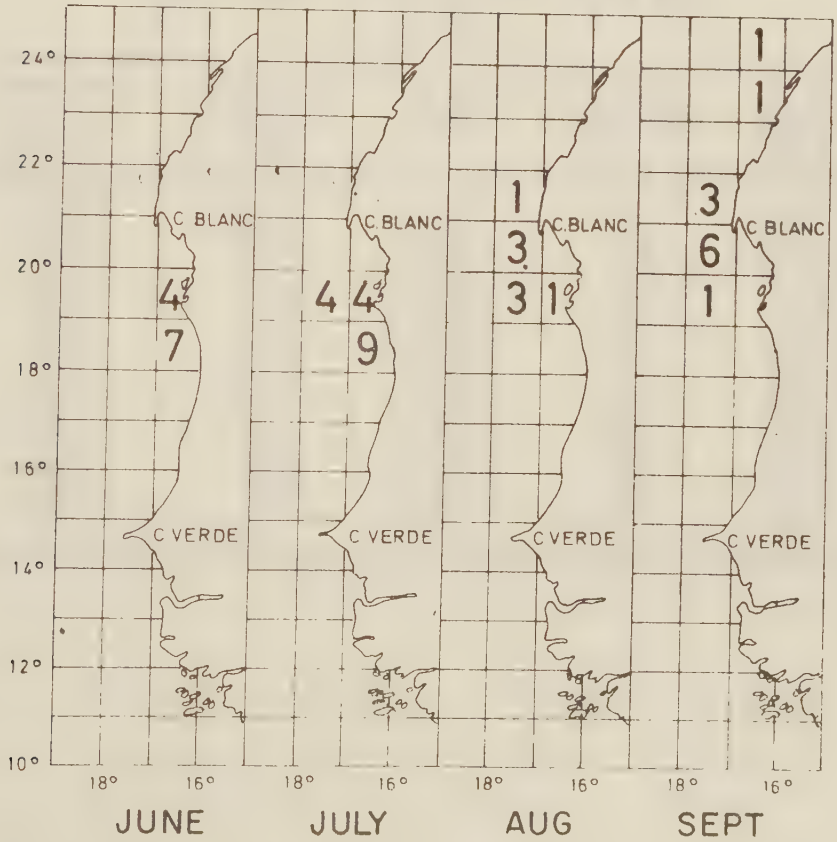


Table 1

The ASTRA expedition 1970
Catch and effort statistics

Month	No. of fishing days	No. of landings	Catch in tons	Catch per fishing day	Landings per fishing day	Catch mean
Mar	54	7	367.4	6.8	0.13	52.5
Apr	312	111	6 999.2	22.4	0.36	63.1
May	284	138	10 403.0	36.6	0.49	75.4
Jun	251	120	8 642.5	34.4	0.48	72.0
Jul	290	116	9 128.8	31.5	0.40	78.7
Aug	208	64	4 155.6	20.0	0.31	64.9
Sep	287	135	11 612.4	40.5	0.47	86.0
Oct	252	163	20 111.7	79.8	0.65	123.4
Nov	290	141	16 012.7	55.2	0.49	113.6
Dec	31	26	3 238.9	104.5	0.84	124.6
Mar–Jul	1 191	492	35 540.9	29.8	0.41	72.2
Aug–Dec	1 068	529	55 131.3	51.6	0.50	104.2
Total	2 259	1 021	90 672.2	40.1	0.45	88.8

Table 2

The ASTRA expedition 1970
Catch statistics for eleven purse seiners

Vessel	No. of fishing days	No. of landings	Catch in tons	Catch per fishing day	Landings per fishing day	Catch mean
1	184	99	10 443.9	56.8	0.54	105.5
2	196	61	6 243.1	31.9	0.31	102.3
3	217	128	10 481.1	48.3	0.59	81.9
4	211	73	4 248.2	20.1	0.35	58.2
5	223	84	6 964.3	31.2	0.38	82.9
6	180	86	5 568.8	30.9	0.48	65.9
7	208	110	11 581.3	55.7	0.53	105.3
8	222	119	11 382.3	51.3	0.54	95.6
9	201	74	7 793.9	38.8	0.37	105.3
10	224	84	6 701.1	29.9	0.38	79.8
11	193	103	9 264.2	48.0	0.53	89.9

Table 3

The ASTRA expedition 1971
Catch and effort statistics

Month	No. of fishing days	No. of landings	Catch in tons	Catch per fishing day	Landings per fishing day	Catch mean
Jan	143	81	6 569.5	45.9	0.57	81.1
Feb	269	185	17 488.2	65.0	0.69	94.5
Mar	303	176	17 126.9	56.5	0.58	97.3
Apr	299	166	14 939.1	50.0	0.56	90.0
May	214	101	8 646.7	40.4	0.47	85.6
Aug	25	8	402.7	16.1	0.32	50.3
Sep	273	130	11 475.9	42.0	0.48	88.3
Oct	273	190	19 858.4	72.7	0.70	104.5
Nov	298	124	9 668.3	32.4	0.42	78.0
Dec	125	31	2 010.0	16.1	0.25	64.8
Jan-May	1 228	709	64 770.3	52.7	0.58	91.4
Aug-Dec	994	483	43 415.3	43.7	0.49	89.9
Total	2 222	1 192	108 185.6	48.7	0.54	90.8

Table 4

The ASTRA expedition 1971
Catch statistics for eleven purse seiners

Vessel	No. of fishing days	No. of landings	Catch in tons	Catch per fishing day	Landings per fishing day	Catch mean
1	192	115	10 063.3	52.4	0.60	87.5
2	218	96	9 898.7	45.4	0.44	103.1
3	228	119	10 669.2	46.8	0.52	89.7
5	221	139	13 991.0	63.3	0.63	100.7
6	215	129	11 422.0	53.1	0.60	88.5
7	213	124	10 342.8	48.6	0.58	83.4
8	208	127	12 732.8	61.2	0.61	100.3
9	210	98	9 946.1	47.4	0.47	101.5
10	206	91	8 249.5	40.0	0.44	90.7
11	149	91	6 610.9	44.4	0.61	72.6
12	162	63	4 259.3	26.3	0.39	67.6

Table 5

The ASTRA expedition 1972
Catch and effort statistics

Month	No. of fishing days	No. of landings	Catch in tons	Catch per fishing day	Landings per fishing day	Catch mean
Jan	190	116	9 579.4	50.4	0.61	82.6
Feb	237	164	14 628.2	61.7	0.69	89.2
Mar	234	133	10 740.8	45.9	0.57	80.8
Apr	229	158	14 157.1	61.8	0.69	89.6
May	246	142	10 679.0	43.4	0.58	75.2
Jun	175	126	10 006.2	57.2	0.72	79.4
Sep	147	73	4 322.7	29.4	0.50	59.2
Oct	251	149	12 103.6	48.2	0.59	81.2
Nov	244	160	15 752.8	64.6	0.66	98.5
Dec	141	114	12 826.7	91.0	0.81	112.5
Jan–Jun	1 311	839	69 790.7	53.2	0.64	83.2
Sep–Dec	783	496	45 005.8	57.5	0.63	90.7
Total	2 094	1 335	114 796.5	54.8	0.64	86.0

Table 6

The ASTRA expedition 1972
Catch statistics for nine purse seiners

Vessel	No. of fishing days	No. of landings	Catch in tons	Catch per fishing day	Landings per fishing day	Catch mean
2	233	124	12 122.5	52.0	0.53	97.8
3	225	127	10 624.9	47.2	0.56	83.7
5	225	152	14 926.4	66.3	0.68	98.2
6	240	183	15 181.2	63.3	0.76	83.0
7	247	160	14 441.2	58.5	0.65	90.3
8	235	139	13 188.1	56.1	0.59	94.9
10	233	136	10 694.3	45.9	0.58	78.6
11	240	172	13 620.7	56.8	0.72	79.2
12	216	142	9 997.3	46.3	0.66	70.4

Table 7

The ASTRA expedition 1973
Catch and effort statistics

Month	No. of fishing days	No. of landings	Catch in tons	Catch per fishing day	Landings per fishing day	Catch mean
Jan	179	116	10 480.4	58.5	0.65	90.3
Feb	227	117	7 467.8	32.9	0.52	63.8
Mar	238	148	9 814.2	41.2	0.62	66.3
Apr	244	163	14 202.1	58.2	0.67	87.1
May	226	119	8 900.1	39.4	0.53	74.8
Jun	231	136	12 840.8	55.6	0.59	94.4
Jul	85	27	2 686.1	31.6	0.32	99.5
Total	1 430	826	66 391.6	46.4	0.58	80.4

Table 8

The ASTRA expedition 1973. Catch statistics
for nine purse seiners (January–July)

Vessel	No. of fishing days	No. of landings	Catch in tons	Catch per fishing day	Landings per fishing day	Catch mean
2	166	98	9 297.1	56.0	0.59	94.9
3	165	91	7 068.6	42.8	0.55	77.7
6	164	108	8 308.2	50.7	0.66	76.9
7	163	101	7 686.0	47.2	0.62	76.1
8	171	105	9 337.3	54.6	0.61	88.9
10	125	64	4 725.7	37.8	0.51	73.8
11	165	94	7 683.5	46.6	0.57	81.7
12	129	70	3 522.0	27.3	0.54	50.3
13	36	16	2 386.5	66.3	0.44	149.2
14	146	79	6 376.7	43.7	0.54	80.7

As several of the purse seiners fishing for ASTRA have participated since 1970, it is of interest to compare the results of each vessel for the different years. In Table 9 the catch per fishing day for each vessel is given. Most of the vessels had a larger catch per fishing day in 1972 than in the two previous years, which probably can be ascribed to improved technique and better knowledge about distribution and fish behaviour in the area.

CATCH COMPOSITION

1970

No data on catch composition for 1970 are available for the ASTRA expedition. The NORGLOBAL expedition started fishing off West Africa in December 1970 and reported a catch of 5 300 tons consisting of 65% horse mackerel and 35% sardinella (Table 11).

1971

The ASTRA reports for 1971 give estimated percentages for the main groups of species: sardinella, horse mackerel and chub mackerel (Table 10). Sardinella (Sardinella aurita and S. eba) contributed 37% of the total catch or about 40 000 tons. The highest percentage was reached in September with 95%. The fleet was then operating off Cape Blanc, mostly to the north. Horse mackerel (Trachurus trachurus, T. trecae and Caranx rhonchus) also yielded 37% of the total catch and dominated the catches during January and November - December. In January the fleet operated off Nouakchott and in November - December in the Cape Blanc area. Chub mackerel (Scomber colias) dominated in February - March and contributed about 26% of the total. The fleet operated in the Nouakchott-St. Louis area most of this period and moved south to the coast of Gambia mid March.

The NORGLOBAL statistics give an estimated percentage of the 1971 catch, split into four groups. Of a total catch of about 93 000 tons, 45% were horse mackerel (Trachurus trachurus and T. trecae), about 10% yellow mackerel (Caranx rhonchus), some 30% sardinella (Sardinella aurita and S. eba) and about 9% chub mackerel (Scomber colias). Very few other fish have been recorded (266 tons of Euthynnus alletteratus). In January - February, when the fishing was concentrated in the Nouakchott area and gradually moved southwards to the St. Louis-Cape Verde area, the horse mackerel were the most abundant species. In November, when fishing was carried out in the area from Cape Timiris to Villa Cisneros, the horse mackerel also dominated the catches. Yellow mackerel (Caranx rhonchus) was found in the catches during March - April - May, with the highest percentage in March (30%). In this period the fleet moved from the Nouakchott area to the Gambia. Chub mackerel (Scomber colias) was well represented (15%) in the April and November catches, and dominated the December catch (75%).

1972

In 1972 biological sampling was carried out on board ASTRA in the periods 24 October-11 November and 26-28 November.

When the fleet operated in the Nouakchott area, yellow mackerel (Caranx rhonchus) and gilt sardinella (Sardinella aurita) dominated the catches during the last days of October. In a few catches the flat sardinella (Sardinella eba) was also abundant. The period 2-9 November yielded almost entire catches of Trachurus trecae, while on 10 and 11 November only Trachurus trachurus was caught. In the period 26-28 November, mixed catches of Trachurus trecae, Caranx rhonchus and Sardinella aurita, and some catches of Trachurus trachurus only were recorded.

During the periods mentioned above only three catches of other species were recorded, one consisting of Sparidae and Pomadasyidae, one of bonito (Sarda sarda) and pampano (Lichia vadigo), and one of bluefish (Pomatomus saltatrix) - the two latter being small catches. Scomber colias were present in small numbers in most catches, as were several other species, but seldom exceeding 1% of the catch.

Table 9

The ASTRA expedition 1970–1973
Catch per fishing day for 14 purse seiners

Vessel	1970	1971	1972	1973 (Jan–Jul)
1	56.8	52.4	-	-
2	31.9	45.4	52.0	56.0
3	48.3	46.8	47.2	42.8
4	20.1	-	-	-
5	31.2	63.3	66.3	-
6	30.9	53.1	63.3	50.7
7	55.7	48.6	58.5	47.2
8	51.3	61.2	56.1	54.6
9	38.8	47.4	-	-
10	29.9	40.0	45.9	37.8
11	48.0	44.4	56.8	46.6
12	-	26.3	46.3	27.3
13	-	-	-	66.3
14	-	-	-	43.7

Table 10

The ASTRA expedition 1971. Monthly catch statistics by species groups in percent and tons

Month	Total catch in tons	Sardinella %	Sardinella tons	Horse mackerel %	Horse mackerel tons	Chub mackerel %	Chub mackerel tons
Jan	6 569.5	30	1 970.8	70	4 598.7	-	-
Feb	17 488.2	10	1 748.8	20	3 497.7	70	12 241.7
Mar	17 126.9	20	3 425.4	30	5 138.1	50	8 563.4
Apr	14 939.1	40	5 975.6	20	2 987.9	40	5 976.6
May	8 646.7	50	4 323.4	50	4 323.3	-	-
Aug	402.7	95	382.6	-	-	5	20.1
Sep	11 475.9	95	10 902.1	-	-	5	573.8
Oct	19 858.4	50	9 929.2	50	9 929.2	-	-
Nov	9 668.3	10	966.8	85	8 218.1	5	483.4
Dec	2 010.0	20	402.0	70	1 407.0	10	201.0
Total	108 185.6	37	40 026.7	37	40 100.0	26	28 060.0

Table 11

The NORGLOBAL expedition 1970–1971. Catch per month by species

Month	Total catch metric tons	Trachurus trachurus & trecae	Caranx rhonchus	Sardinella aurita & eba	Scomber colias	Various species	Number of catches	Catch mean
1970								
Dec	5 290.3	3 391.0		1 899.3			46	115.0
1971								
Jan	9 196.9	9 196.9					80	114.9
Feb	13 051.8	12 786.8		265.0			111	117.6
Mar	15 507.2	5 107.6	4 165.5	6 069.9	164.2		125	124.1
Apr	9 953.4	998.2	3 825.5	3 606.7	1 523.0		95	104.8
May	4 424.6		1 174.5	2 328.5	921.6		59	74.9
Spring	52 133.9	28 089.5	9 165.5	12 270.1	2 608.8		470	110.9
Aug	2 222.8	79.9		1 876.9		266.0	35	63.5
Sept	10 473.6	1 207.9		8 689.2	576.5		89	117.7
Oct	11 246.9	3 649.2		7 597.7			96	117.2
Nov	12 200.7	8 857.1	273.1	853.8	2 216.7		134	91.1
Dec	4 540.5	924.8		290.5	3 325.2		56	81.1
Autumn	40 684.5	14 718.9	273.1	19 308.1	6 118.4	266.0	410	99.2
1971	92 818.4	42 808.4	9 438.6	31 578.2	8 727.2	266.0	880	105.5

Various species: Euthynnus alletteratus August

Table 12

The NORGLOBAL expedition 1972. Catch per month by species

Month	Total catch metric tons	Trachurus trachurus & trecae	Caranx rhonchus	Sardinella aurita & eba	Scomber colias	Various species	Number of catches	Catch mean
Jan	11 539.0	9 681.1		1 733.8	124.1		105	109.9
Feb	14 351.4	1 299.6	80.7	12 323.4		647.7	122	117.6
Mar	9 807.9		338.6	8 650.7	818.6		99	99.1
Apr	15 209.0	232.2	824.9	14 151.9			124	122.7
May	7 462.5	78.2		7 293.9		90.4	79	94.4
Spring	58 369.8	11 291.1	1 244.2	44 153.7	942.7	738.1	529	110.3
Jun	687.3			687.3			14	49.1
Jul	2 566.1			2 420.9		145.2	31	82.8
Aug	865.7			834.2	10.6	20.9	14	61.8
Sep	2 368.2	950.2		714.9	703.1		34	69.7
Oct) Nov) Dec)	Data not received							
Autumn	6 487.3	950.2		4 657.3	713.7	166.1	93	69.8
1972	64 857.1	12 241.3	1 244.2	48 811.0	1 656.4	904.2	622	104.3

Various species: Feb Mixed small fish
May Tuna (not specified)
Jul Euthynnus alletteratus (47.2 tons), Pomatomus saltatrix (98.0 tons)
Aug Pomatomus saltatrix

First half of June, expedition to Las Palmas; second half only two purse seiners operating.

The NORGLOBAL statistics for 1972 give the same grouping of species as for 1971. No data for October - December have been received. Horse mackerel dominated in January while sardinella dominated for the rest of the spring season (March-May). The summer season (June-September) yielded mostly sardinella, while horse mackerel and chub mackerel appeared again in September. Of the 1972 catch (not including the last three months) sardinella amounted to 75%, horse mackerel 19%, chub mackerel 3%, yellow mackerel 2%, while other species contributed only about 1%.

REFERENCE

Ostvedt, O.J., 1972 Report on the Norwegian pelagic fishery off West Africa 1970 and 1971. Paper presented to CECAF Working Party on Resources Evaluation, Rome, 14-20 April 1972. 6 p. (mimeo)

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Appendix 8

EFFECTS OF THE UNREPORTED SPANISH CATCHES ON THE APPRAISAL OF POTENTIAL YIELD OF CEPHALOPODS[1]

by

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INTRODUCTION

1 From 1971 to 1972 the reported Spanish catch of cephalopods suddenly increased from 45.2 to 112.2 thousand tons; however, according to general information on the Spanish fishery (Dr. Bas, pers.comm.), fishing activity has remained more or less the same during the last 10 years and, therefore, such an increase cannot reflect an expansion of fishing (effort and catches) but rather should result from an improvement in allocation of Spanish catches by fishing areas and from better reporting. This would imply that prior to 1972 a substantial amount of Spanish catches from the CECAF region had not been reported and that subsequently Spanish effort, and thus total effort, had been underestimated in previous assessments of the stocks .

ASSUMPTIONS

2 Four assumptions can be made regarding the Spanish effort during the period 1964/1971:

A Spanish catches reported to FAO are correct

B Annual Spanish catch remained constant over the whole period and equal to the figure reported for 1972

C Spanish effort remained constant and the corresponding c.p.u.e. varied as did the Japanese c.p.u.e. The year 1972 has again been taken as the reference year to estimate Spanish effort for previous years

D Spanish vessels have caught a constant percentage of the total catch. Here again the 1972 figures were used as reference values

3 Of these four assumptions the first and the last are the less likely and the actual situation should be somewhere between assumptions B and C (probably nearer to C); however, in order to detect what effects can be expected from the unknown Spanish catches, all assumptions were worked out. Basic data and the method used are presented in Table 1.

RESULTS

4 Calculations were made for each set of catch and effort corresponding to each assumption, and for each set of cephalopod species, together and separately.

1/ Since time available during the Working Party meeting was too short to make the calculations corresponding to various assumptions on the fishing effort exerted by Spanish vessels fishing for cephalopods, it was agreed that such analysis would be carried out by the Secretariat after the session

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Table 1

a) Basic data

	1964	1965	1966	1967	1968	1969	1970	1971	1972
Japanese abundance indices (kg/h fishing): x									
Cuttlefish	348	291	167	162	110	82	55	56	70
Octopus	161	119	160	130	189	89	101	81	59
Squid	86	68	38	52	33	26	30	54	30
Total	595	478	365	344	332	197	186	191	159
Reported Spanish catch ('000 tons): y									
Cuttlefish	6.6	8.2	7.7	7.8	7.7	6.5	4.9	4.9	12.0
Octopus	8.5	35.9	39.1	41.6	41.7	29.3	20.0	20.0	87.3
Squid	5.1	3.5	4.7	6.1	5.4	6.5	7.4	7.4	12.9
Total	20.2	47.6	51.5	55.5	54.8	51.2	42.7	45.2	112.2
Total catch minus Spain ('000 tons): z									
Cuttlefish	19.2	31.9	29.4	35.1	29.0	27.4	15.9	16.9	18.5
Octopus	10.4	33.4	23.3	55.7	66.4	53.2	51.3	38.7	27.4
Squid	13.4	9.9	6.3	8.2	6.3	9.6	6.6	7.9	13.0
Total	33.0	75.6	49.0	99.0	100.8	89.2	73.8	53.5	38.9

b) Calculations

		1964	1965	1966	1967	1968	1969	1970	1971	1972
Assumption A	Effort = $\frac{y+z}{x}$									
	Cuttlefish	74	138	222	265	335	413	378	389	436
	Octopus	117	582	390	749	567	927	706	725	1 944
	Squid	215	197	290	275	355	619	467	283	863
	Total	89	258	303	449	469	713	629	569	1 076
Assumption B	Effort = $\frac{y'72+z}{x}$									
y'72=12.0	Cuttlefish	90	151	248	291	373	481	507	338	436
y'72=87.3	Octopus	607	1 014	691	1 100	813	1 579	1 372	1 556	1 944
y'71=12.9	Squid	306	335	505	406	582	865	650	385	863
y'71=112.2	Total	244	393	442	614	642	1 022	1 054	868	1 076
Assumption C	Effort = $\frac{y'72}{x'72} + \frac{z}{x}$									
$\frac{y'72}{x'72}$ = 170	Cuttlefish	227	281	347	388	436	506	460	473	436
$\frac{y'72}{x'72}$ = 1 480	Octopus	1 544	1 761	1 625	1 908	1 831	2 078	1 987	1 988	1 944
$\frac{y'72}{x'72}$ = 430	Squid	586	575	595	589	621	800	650	576	863
$\frac{y'72}{x'72}$ = 706	Total	761	864	840	993	1 006	1 209	1 103	986	1 076
Assumption D	Effort = $(1+\frac{y'72}{z'72})\frac{z}{x}$									
$\frac{y'72}{z'72}$ = 0.65	Cuttlefish	91	181	290	357	435	551	476	498	436
$\frac{y'72}{z'72}$ = 3.19	Octopus	270	1 099	609	1 794	1 471	2 502	2 126	2 000	1 944
$\frac{y'72}{z'72}$ = 0.99	Squid	311	290	329	314	362	735	437	324	863
$\frac{y'72}{z'72}$ = 1.90	Total	161	459	390	836	882	1 815	1 153	814	1 076

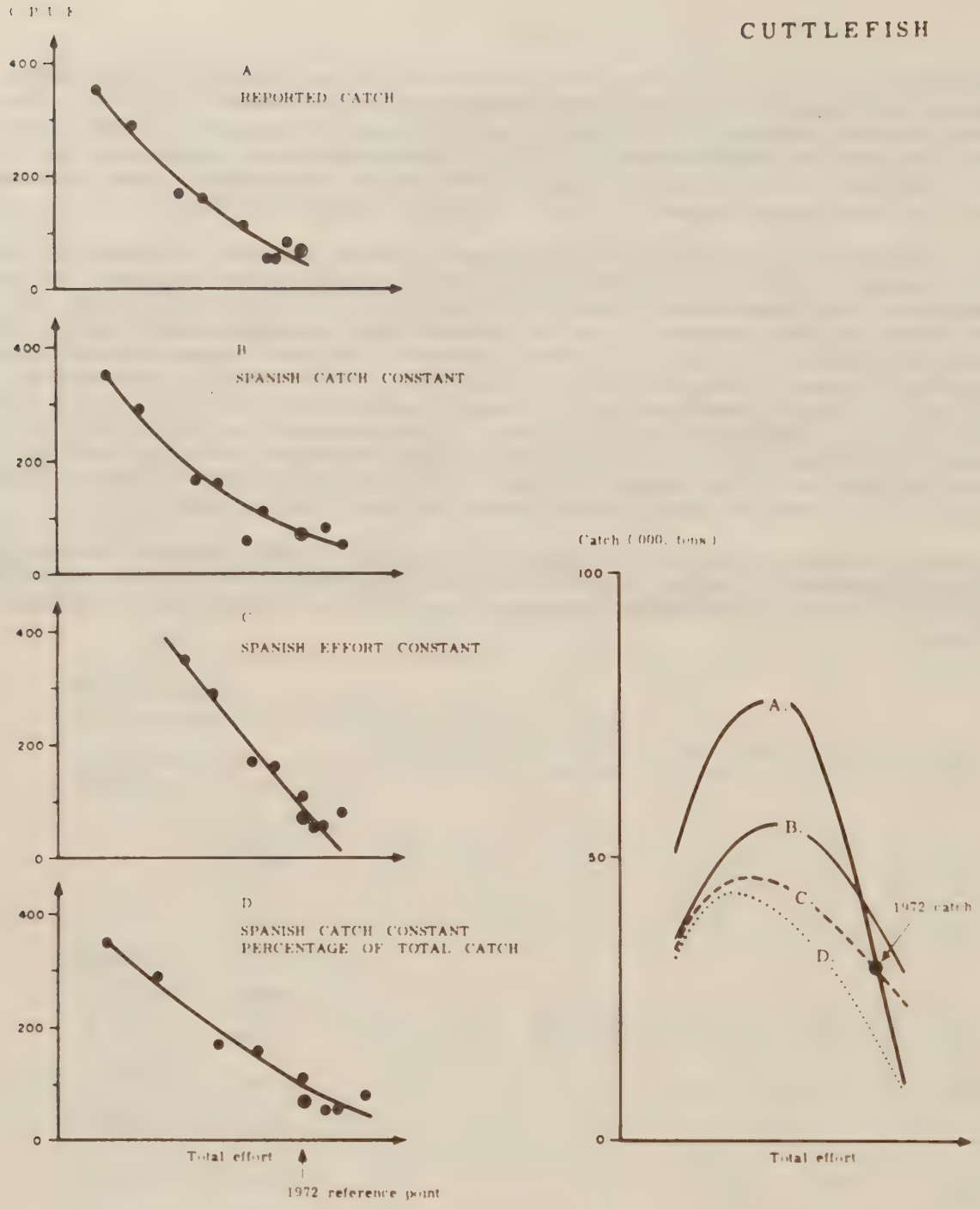
5 Relationship between c.p.u.e. and total effort for the same year and corresponding equilibrium yield curves for the abovementioned assumptions are shown in Figs 1-4. The first three figures correspond to assessments made for each of the groups of species—i.e. cuttlefish, octopus and squid—separately. Fig. 4 corresponds to all cephalopod species combined. Plotting c.p.u.e. and yield against total effort exerted in the same year seems reasonable for cephalopods because of their very short lifespan (1-2 years).

6 As a consequence of uncertainty regarding actual Spanish catches, the answers—both in terms of maximum potential catch and present level of exploitation—obtained from the four assumptions vary considerably; however, if assumptions B and C are considered to represent better the true picture, it can be concluded that the effort level corresponding to MSY has been exceeded and that any further increase in the rate of exploitation would result in smaller total catches and reduced catch rates. On this basis a reduction in fishing effort of some 40% below that of 1972 would increase the total catch of all cephalopods by some 10 to 100% above the 1972 figure. This conclusion does not seem to be unlikely when considering that the total Japanese catches went down from 98 000 tons in 1968 to 48 000 tons in 1972—a reduction of about 50%—whereas the overall nominal effort is believed to have remained fairly stable during the whole period reviewed.

7 It therefore appears advisable to introduce regulatory measures aiming at reducing and controlling the amount of fishing. This is even more important as there seems to be little possibility to increase yield through changes in mesh size (see conclusions of section 2.1.3 in the report).

* * * * * *

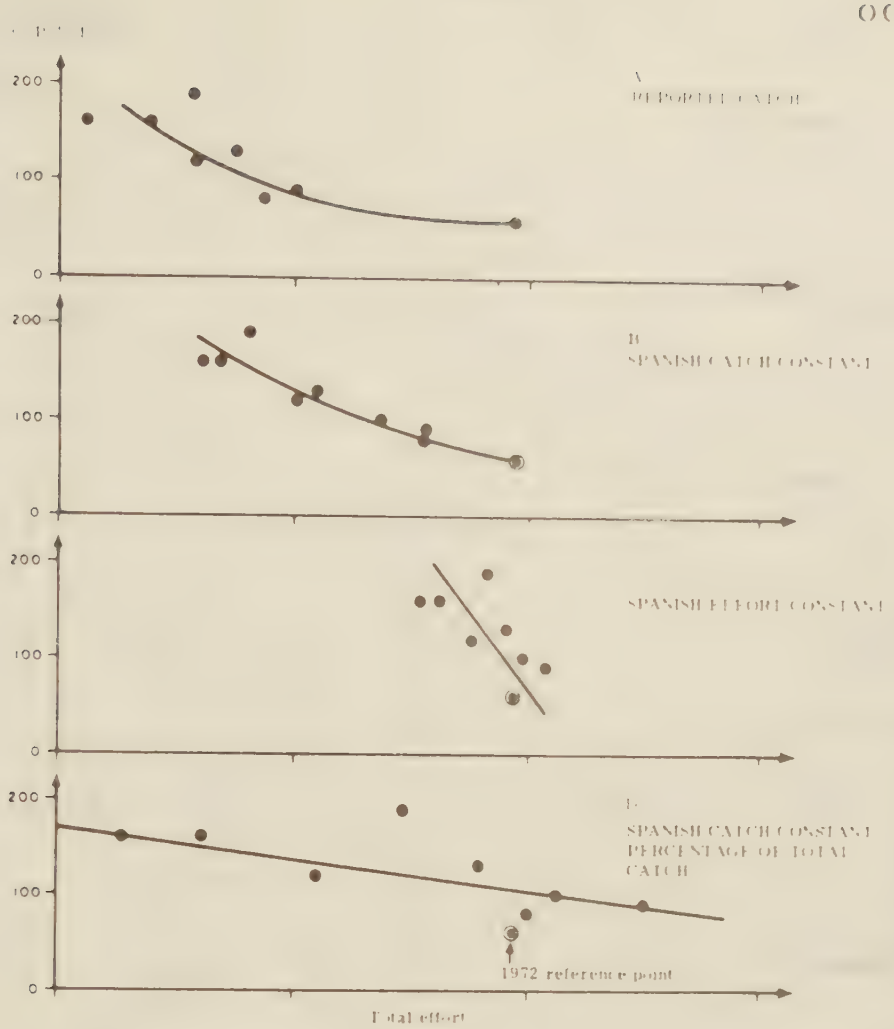
CUTTLEFISH



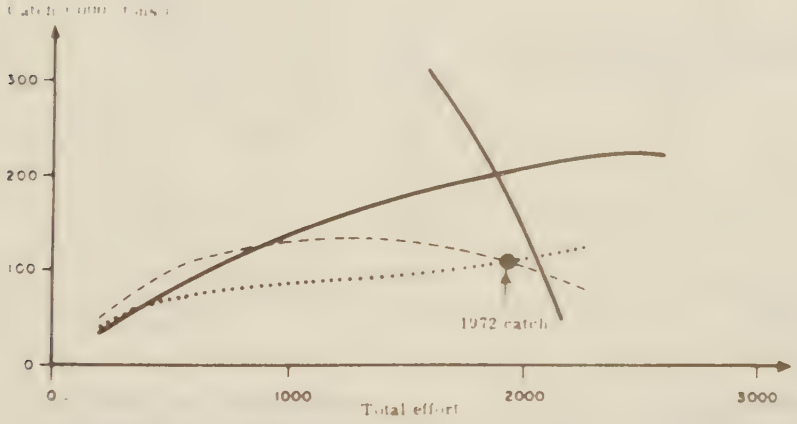
a) c.p.u.e. /total effort relationships

b) equilibrium yield curves

Fig. 1 Cuttlefish: effects of various assumptions for Spanish catches in the CECAF region on c.p.u.e. / effort and equilibrium yield curves.

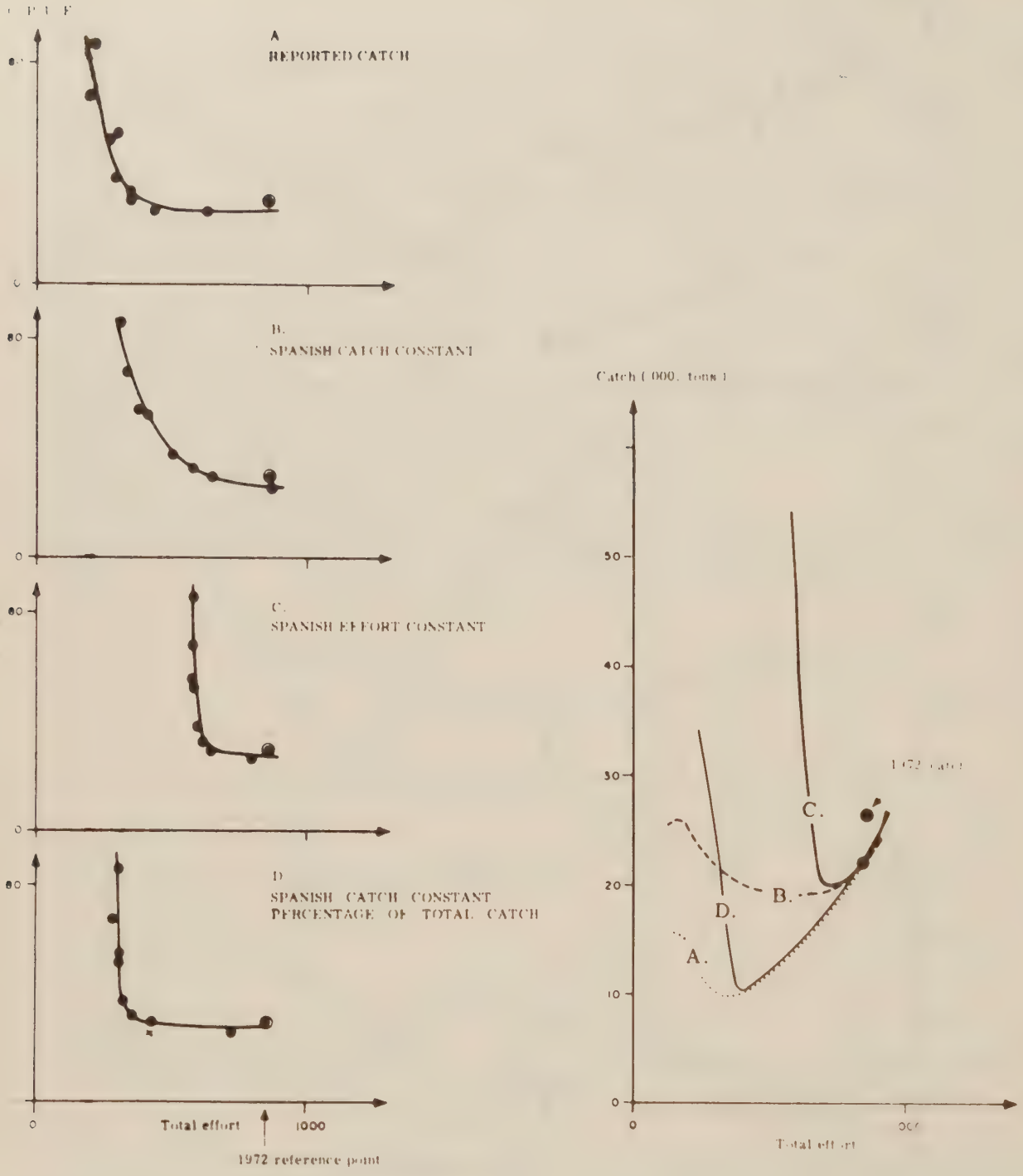


a) c.p.u.e. / total effort relationship



b) equilibrium yield curves

Fig. 2 Octopus: effects of various assumptions for Spanish catches in the CECAF region on c.p.u.e./effort and equilibrium yield curves

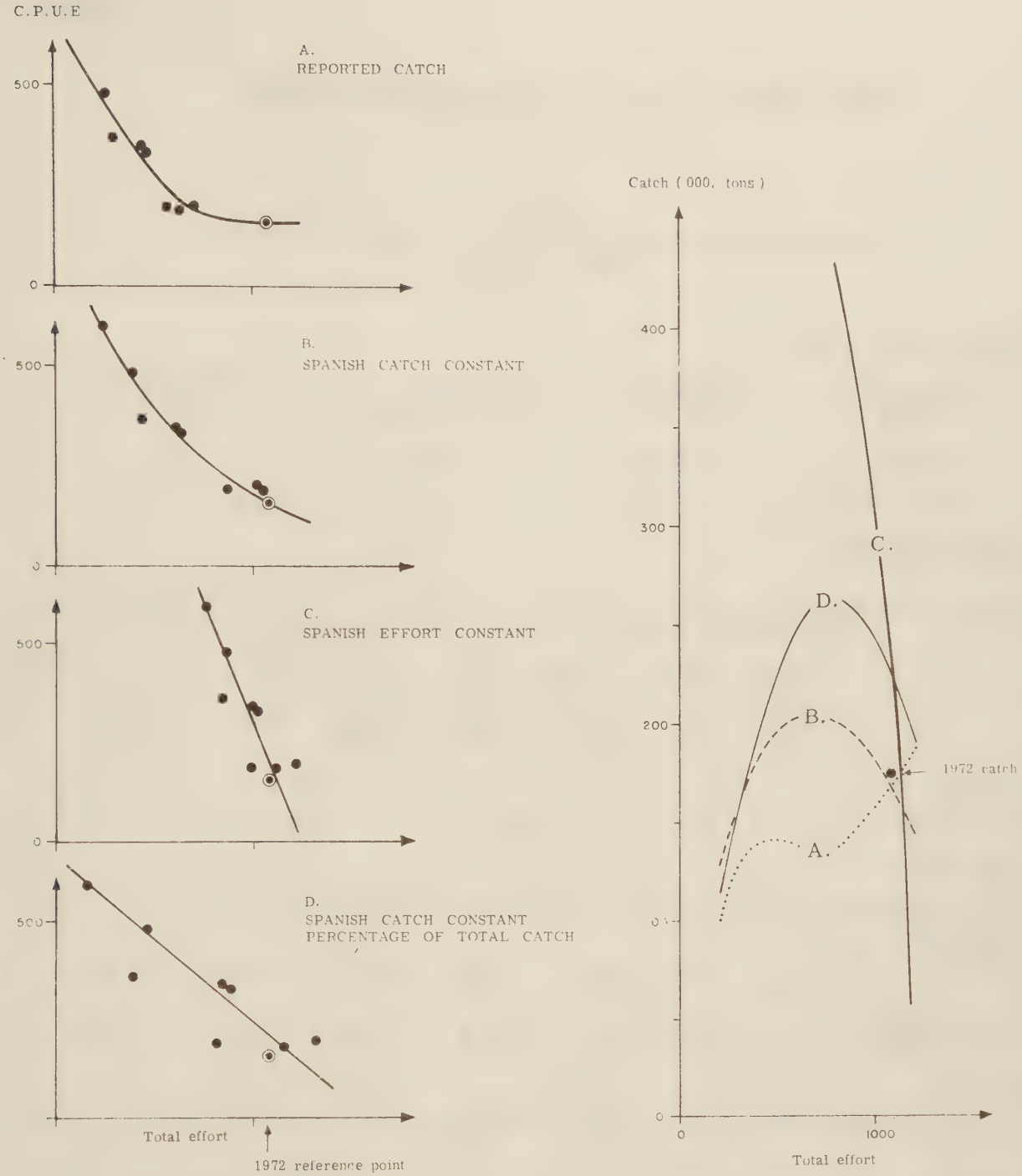


a) c.p.u.e. / total effort relationships

b) equilibrium yield curves

Fig. 3 Squid: effects of various assumptions for Spanish catches in the CECAF region on c.p.u.e./effort and equilibrium yield curves

ALL CEPHALOPODS combined



a) c.p.u.e./total effort relationships

b) equilibrium yield curves

Fig. 4 All cephalopods combined: effects of various assumptions for Spanish catches in the CECAF region on c.p.u.e./effort and equilibrium yield curves.

Appendix 9

FRENCH SELECTIVITY DATA FOR SQUID AND *Pagellus bellotti* (R/V THALASSA, JULY 1973)

by

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A. Squid (Mantle length)

Type of trawl	Internal mesh size	$L_{50\%}$ retained	Selection factor
GOV 36/47	73.8 mm	11.9 cm	1.61
Trad. 35/55	72.8 mm	14.6 cm	2.01

B. *Pagellus bellotti*

Type of trawl	Traditional trawl 35/55 (72.8 mm)				High-opening trawl GOV 36/4 (73.8 mm)			
	Covered codend		Alternate hauls		Covered codend		Alternate hauls	
	Inner codend	Cover	Large mesh	Small mesh	Inner codend	Cover	Large mesh	Small mesh
L_{50} retained	20.3		20.6		20.7		21.2	
Selection factor	2.78		2.83		2.80		2.87	
Selection range 25-75%	3.9		5.1		3.1		4.4	
No. *P. bellotti* in selection range	461	1 067	676	1 253	932	1 210	1 510	3 217
Weight *P. bellotti* in catch (kg/h)	43.8	22.6	45.1	66.4	130.5	55.8	130.4	186.3
Weight total catch (kg/h)	295	86	320.7	381	299.5	212.7	370	512.2
No. of hauls	6		5	6	7		5	7
Mean duration	54'		58'	54'	56'		62'	56'
Speed	Range 3.6 - 5.0 knots, average 4.3 knots							

* * * * * *

MR/F6055/E/2.75/1/600